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FINAL VOLUME
See Notice Inside

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ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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NUCLEAR SCIENCE ABSTRACTS

A semimonthly publication of the USERDA Office of Public Affairs
Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

The following organizations scan and abstract the nuclear science literature in their respective countries for input to the International Nuclear Information System of the International Atomic Energy Agency. By special agreement, the input to INIS is simultaneously sent to the ERDA Technical Information Center to enhance the timeliness of coverage of that literature in *Nuclear Science Abstracts*.

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Australian Atomic Energy Commission
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Institutt for Atomenergi (Norway)
Aktiebolaget Atomenergi (Sweden)
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Zentralstelle für Atomkernenergie-Dokumentation (West Germany)

Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

NOTICE

The publication of *Nuclear Science Abstracts* is planned to be discontinued after Vol. 33, No. 12, dated June 30, 1976. *Atomindex*, published by the International Atomic Energy Agency and a product of the International Nuclear Information System (INIS), will provide essentially identical literature coverage, subject scope, abstracting and indexing with that of *NSA*. For all practical purposes the two journals are identical. The Energy Research and Development Administration, formerly the Atomic Energy Commission, has supported the concept and development of INIS for several years. At this time, it is quite apparent that the decentralized scanning, abstracting and indexing on a country-by-country basis is reliable and successful. Consequently, it is no longer necessary for the United States to bear the entire burden of publishing an abstract journal covering the world's nuclear literature. ERDA will continue to provide coverage of U. S. nuclear literature to INIS.

Atomindex is available on a subscription basis from UNIPUB, P. O. Box 433, Murray Hill Station, New York, New York 10016, for $150 per year including cumulative indexes. ($100 per year without cumulative indexes.)

ERDA's new journal, *ERDA Energy Research Abstracts (ERA)*, will contain abstracts and indexes to all literature of ERDA origin as well as nonnuclear energy information generated by foreign countries with which ERDA has agreements for cooperation. *ERA* is available to government agencies on the same basis as *NSA* and on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information.

The public may obtain *ERA* from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402. The annual subscription rate for the 12 regular issues including an annual cumulative index is $119 for domestic subscribers, and $148.75 for foreign subscribers. Individual issues will be priced at $7.40 domestic, and $9.25 foreign. Separate annual index cumulations will cost $30.50 domestic, and $38.15 foreign.

INDEXES TO *NSA*

Comprehensive indexes appear in each issue and are cumulated at the end of each volume. The report number indexes will be cumulated on both a volume and two-volume basis. Multivolume cumulations have been issued as indicated above.

All documents abstracted are indexed by subjects and personal authors. Report literature is indexed also by corporate author and report number. Each of these indexes in every issue is preceded by an introduction explaining in detail the organization of the index and the principles by which it is compiled. The reader is referred to these explanations for information not found in the brief summaries below.

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Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

SOLDAN, D.W., Shipping container for a bottle of radioactive material, 32:20442
SOLDAT, J.K., Dosimetry of the radioactive noble gases, 32:19918 (BNWL-SA-4813)
SOLOMAKHA, D.A., Measurement of the 1.15-μm wavelength of a helium--neon laser, 32:19555

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

URANIUM ORES/GEOCHEMISTRY
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URANIUM ORES/LEACHING
Preparation of uranium compounds (Patent), 32:19329
URANIUM ORES/MINING
The uranium mining and its importance for the energy supply, 32:19701
URANIUM ORES/ORE PROCESSING
Supplies for the fuel cycle for Spanish nuclear power plants, 32:19702
URANIUM OXIDES
See also URANIUM DIOXIDE
URANIUM OXIDES U3O8

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

20457 (LA-5954) 100-MHz POWER AMPLIFIER DESIGN AND CONTROL FOR A HEAVY-ION ACCELERATOR. Lunsford, J. S.; Shipley, J. P.; Sutton, J. **(Los Alamos Scientific Lab., N. Mex. (USA)).** Jul 1975. 11p. Dep. NTIS $4.00.

is indexed as:

LOS ALAMOS SCIENTIFIC LAB., N.MEX. (USA)
100-MHz power amplifier design and control for a heavy-ion accelerator, 32:20457 (LA-5954)
Characterization of transuranic solid wastes from a plutonium processing facility, 32:19398 (LA-5993-MS)
Electrical breakdown and tracking characteristics of pulsed high voltages in cryogenic helium and nitrogen, 32:19495 (LA-UR-75-1032)
Engineering concepts for laser-fusion reactor applications, 32:19493 (LA-UR-75-736)
Evaluation of pre-impregnated resin-glass systems for insulating superconducting magnets, 32:19583 (LA-UR-75-1099)

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Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

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2429	32:20210	Dep. NTIS, $12.00
5931	32:21563	Dep. NTIS, $5.45
LA-tr-		
75-14	32:21506	Dep. NTIS, $7.75
75-26	32:19253	Dep. NTIS, $4.00
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75-791	32:20772	Dep. NTIS, $4.50
75-1331	32:19238	Dep. NTIS, $4.00
LBL-		
2874	32:19889	Dep. NTIS, $9.25
3633	32:21097	Dep. NTIS, $13.50
LFEN-	(Portugal)	
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Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from Xerox University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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The Administrator of the Energy Research and Development Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

Volume 33, Number 4 February 29, 1976

NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

6902 INSTRUMENTAL ACTIVATION DETERMINATION OF HALIDES IN BIOLOGICAL OBJECTS. Kirst, A. A.; Kryzhenkova, N. A.; Tushkova, R. Ya.; Miranskii, I. A.; Il'ina, T. G.; Pyzhova-Ioffe, I. K.; Lobanov, E. M. pp 387-392 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Methods were developed for the neutron activation determination of Cl, Br, and I. Thermal neutrons were used for Cl, resonance neutrons for Br, and either thermal or resonance neutrons for I depending on the form of the material to be analyzed. The methods developed were applied to eye tissue with satisfactory results. (JSR)

6903 USE OF ACTIVATION ANALYSIS IN THE PRACTICE OF CLINICAL AND EXPERIMENTAL MEDICINE. Kist, A. A.; Lobanov, E. M.; Kryzhenkova, N. A.; Sviridova, A. I.; Kist, S. M.; Tushkova, R. Ya.; Miranskii, I. A.; Kirzhner, M. A. pp 392-398 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

In the analysis of biological materials in clinical and experimental medicine high efficiency, sensitivity, and simplicity is required. The ways in which activation analysis fulfill these requirements are outlined. Activation analysis methods were developed for 36 elements. Examples are given of studies in which these methods are being used. (JSR)

Activation and Nuclear Reaction Procedures

6904 (EURISOTOP-99) INVENTORY OF ACTIVATION ANALYSIS FACILITIES AVAILABLE IN THE EUROPEAN COMMUNITY TO INDUSTRIAL USERS. Pauwels, J. (Commission of the European Communities, Brussels (Belgium). Bureau Eurisotop). May 1975. 85p. Dep. NTIS (US Sales Only) $6.00.

Lists of activation equipment produced in the European Community, facilities available for industrial users, and activation laboratories existing in European companies are given. (LK)

6905 HIGH PRECISION INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF URANIUM BY MULTIPLE GAMMA-RAY PEAK RATIO DETERMINATION. Mantel, M.; Amiel, S. (Soreq Nuclear Research Center, Yavne, Israel). J. Radioanal. Chem.; 26: No. 1, 97-105(1975).

The method of multiple γ-ray peak ratio determination has been applied to the nondestructive neutron activation analysis of uranium in rocks and ores. The photopeaks of ^{239}Np gamma-rays produced by the activation of ^{238}U and those of the fission products of ^{235}U are a measure of the quantity of uranium in the irradiated sample, provided that the uranium is of natural isotopic composition. The ratios between the integrated areas of the different photopeaks are calculated and compared with those obtained for a uranium standard. The uranium concentration in the sample is calculated from the photopeaks whose ratios correspond, within the error limits, to those of pure natural uranium. High accuracy better than ±2% has been obtained. (auth)

6906 MULTIELEMENT STANDARDS FOR INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS OF BIOLOGICAL MATERIALS. Mosulishvili, L. M.; Kolomi'tsev, M. A.; Dundua, V. Yu.; Shonia, N. I.; Danilova, O. A. (Inst. of Physics, Academy of Sciences of Georgian Republic, Tbilisi, USSR). J. Radioanal. Chem.; 26: No. 1, 175-188(1975).

Standards for instrumental neutron activation analysis (INAA) of biological materials are proposed. The standards are multielement solid solutions in phenol-formaldehyde resole resin (PFR) moulded as pellets weighing 30 to 50 mg. The concentrations of trace elements in the standards are selected so that, firstly, they are commensurable with their concentrations in the biological materials and, secondly, that the analytical lines of each of the elements incorporated in PFR are resolved with the aid of modern equipment. The principal standard contains 21 trace elements from among those of greatest interest for INAA of biological materials. This standard is recommended for work on high-resolution equipment. At the same time, standards of simpler trace element composition have been prepared and studied which can be used in work on simpler equipment or in solving particular problems in determination of certain groups of chemical elements. (auth)

6907 PROTON ACTIVATION ANALYSIS FOR CHROMIUM, NICKEL, AND COPPER. Krivan, V. (Max-Planck Inst. fuer Metallforschung, Stuttgart). J. Radioanal. Chem.; 26: No. 1, 151-163(1975).

Proton activation analysis has been applied to develop a procedure for the simultaneous determination of chromium, nickel, and copper. The procedure involves the bombardment of the sample with protons to induce ^{52}Cr(p,n)^{52m}Mn, ^{60}Ni(p,n)^{60}Cu and ^{63}Cu(p,n)^{63}Zn reactions. These reactions have been studied for proton energies from 11 MeV to 15 MeV. Thick target yields for the production of the indicator radionuclides as well as the sensitivities of the determination have been measured in this energy region and are compared with results obtained for other charged particle induced reactions. Detailed data are given on nuclear and instrumental interferences. The trace elements have been determined nondestructively and simultaneously in cobalt with a relative precision of 8 to 15%. (auth)

6908 OPTIMIZATION OF IRRADIATION AND DECAY TIMES IN NUCLEAR ACTIVATION ANALYSIS. Watterson, J. I. W. (Univ. of the Witwatersrand, Johannesburg). J. Radioanal. Chem.; 26: No. 1, 135-150(1975).

A mathematical model has been developed to describe the behavior of the statistical error in the determination of gamma-ray peak areas in instrumental activation analysis as a function of the irradiation and decay times. This model has been used to investigate the best values of these parameters for the determination of a particular peak in a complex spectrum. It has also been used to investigate the effect of the maximum count rate on the best precision obtainable. (auth)

6909 STUDIES ON THE NON-UNIFORMITY OF FINE DISPERSIVE MIXTURES BY INSTRUMENTAL ACTIVATION METHOD. Smakhtin, L. A.; Kurinov, A. D.; Merkulov, A. V.; Sinaysky, U. M. (Karpov Inst., Obninsk, USSR). J. Radioanal. Chem.; 26: No. 1, 127-134(1975).

The uniformity of ferrit charge component distribution affects

significantly the magnetic properties of the final products. A characteristic feature of mixing efficiency is the concentration distribution of the components present in low concentration. It was the aim of the present research to investigate the variants of the instrumental activation technique to measure cobalt, sodium, and copper in ferrite charge. All data obtained were treated by the technique of the simple dispersion analysis. The effect of some systematic errors on the statistical parameters under consideration have been studied. Means of quantitative estimation of non-uniformity have also been discussed. (auth)

6910 DETERMINATION OF PHOSPHORUS IN SEMICONDUCTOR-GRADE SILICON BY NEUTRON ACTIVATION ANALYSIS. Jaskolska, H.; Rowinska, L. (Inst. of Nuclear Research, Swierk, Poland). J. Radioanal. Chem.; 26: No. 1, 31-37(1975).

A method of determination of phosphorus in silicon has been elaborated. The separation of phosphorus is based on the extraction of phosphomolybdic complex in the presence of hold-back carriers of Ta and Au. Contamination factors for various impurities were determined. The lower limit of determination equals $3 \cdot 10^{-11}$ g P. Types of errors in the determination of concentration profiles are discussed. (auth)

6911 RAPID ASSESSMENT OF THERMAL NEUTRON ACTIVATION IN CONSIDERATION OF TIME AFTER IRRADIATION. Okada, M. (Japan Atomic Energy Research Inst., Tokai). J. Radioanal. Chem.; 26: No. 1, 215-219(1975).

The shapes of equiactivation lines (lines indicating the equal height of specific activity at a time after irradiation) in a broad sense are presented. The usefulness of the lines is shown in an example of assessment. (3 figures) (auth)

6912 IMPROVEMENTS IN OR RELATING TO THE ANALYSIS OF MATERIALS. Pierce, T. B. (to United Kingdom Atomic Energy Authority). British Patent 1,389,838/B/. 9 Apr 1975. Filed date 10 Sep 1971. 4p.

Information concerning the composition of a material can be obtained by irradiating it with neutrons and measuring the proportion absorbed by the specimen. Such neutron techniques can be applied to the determination of elements having high neutron capture cross sections present in material having a relatively low neutron capture cross section. The results obtained give the quantity of absorbers per unit area perpendicular to the incident neutrons, and to convert this information to absolute concentration the total quantity of sample per unit area perpendicular to the neutron beam must also be known. This may be found by measuring the transmittance of the sample to a second kind of radiation that is absorbed by both the matrix and specimen materials. The required apparatus comprises means for positioning a combined source of neutrons and γ-radiation near the specimen to be analysed, together with a detector responsive to both neutrons and γ-radiation, to give a signal related to the intensity of the neutrons incident on the detector and a second signal related to the intensity of γ rays incident on the detector. A pulse height analyser is adapted to give an output signal indicative of the intensity of the neutrons which have traversed the specimen and a second signal indicative of the intensity of the γ rays that have traversed the specimen. (UK)

6913 RAPID DETERMINATION OF SILVER TO SILVER PLUS COPPER RATIOS IN COINS USING 14 MeV NEUTRON ACTIVATION ANALYSIS. Ware, A. R.; Bibby, D. M. (Univ. of Tech., Loughborough, Eng.). J. Radioanal. Chem.; 27: No. 1, 95-103(1975).

A non-destructive method for the analysis of the silver to silver plus copper ratio in coins using 14 MeV neutron activation analysis has been studied. The mass of silver to the mass of copper is obtained by measuring the 0.511 MeV annihilation radiation emitted by ^{64}Cu and ^{108}Ag at two separate times after irradiation. A series of British silver three-penny pieces dated 1891-1941 were analyzed and agreed well with the mint assay. The interference from the presence of zinc in some coins was investigated. (auth)

6914 RESONANCE ACTIVATION ANALYSIS OF IODINE. Al-Shahristani, H.; Abbass, K. (Univ. of Baghdad, Iraq). J. Radioanal. Chem.; 27: No. 1, 105-113(1975).

Resonance neutron activation and γ ray spectrometry were used to determine traces of iodine in biological materials. The method developed is purely instrumental and fairly rapid. The major interfering activities of ^{24}Na, ^{38}Cl, ^{56}Mn and ^{82}Br were significantly reduced by irradiating the samples inside a shield of Cd, NaCl, $MnBr_2$ and MnO_2. Neutrons with energies close to the resonances of Na, Cl, Mn and Br were absorbed in the shield and did not activate the sample while neutrons with energies close to the resonances of iodine were not absorbed appreciably. Thus the activity of ^{128}I was enhanced relative to the interfering activities. The 442-keV γ of ^{128}I (T = 25 min) was measured using a high-resolution Ge(Li) detector and a multichannel analyzer. Sensitivity of 0.05 ppM was obtained. (auth)

6915 IN-BEAM NEUTRON ACTIVATION ANALYSIS OF STAINLESS STEEL AND IRON ORE. Najam, M. R.; Anwar-Ul-Islam, M.; Ishaq, A. F. M.; Mirza, J. A.; Khan, A. M.; Qureshi, I. H. (Pakistan Inst. of Nuclear Science and Tech., Rawalpindi). J. Radioanal. Chem.; 27: No. 1, 115-124(1975).

Neutron capture γ-ray activation analysis technique has been used for the nondestructive analysis of Fe, Cr, Ni, Mn and B in stainless steel and iron ore samples. It has been shown that the use of low energy capture γ-rays, ranging from 0.2 to 1.4 MeV, helps considerably in reducing the time of analysis. The problem of congestion of peaks due to compton continuum and the double and single escape peaks in this region of the spectrum has been overcome by using a Ge(Li) detector in conjunction with a 15.25 cm thick bifurcated NaI(Tl) annulus in anticompton mode. The results obtained by this technique have been compared with those of the chemical analysis. (auth)

6916 ANALYTICAL DETERMINATION OF MICROELEMENTS IN WELL WATERS. Bunus, F.; Dumitrescu, P.; Bulaceanu, R. (Inst. of Atomic Physics, Bucharest). J. Radioanal. Chem.; 27: No. 1, 77-81(1975).

Well water analysis was carried out starting with liquid samples which have been evaporated to dryness. The salt deposit crust has ensured an enrichment in microelements which were approximately determined by emission spectroscopy. Once the order of magnitude was established, the exact measurements were carried out based on the following techniques: mass spectrometry, atomic absorption spectrophotometry, activation with slow neutrons, and γ-spectrometry. The results obtained are the average values of at least three methods employed. (auth)

6917 COMPARISON OF ACTIVATION METHODS FOR MERCURY DETERMINATION. Al-Shahristani, H.; Abbass, K. (Univ. of Baghdad, Iraq). J. Radioanal. Chem.; 27: No. 1, 57-65(1975).

A comparative study is made on different activation methods for mercury analysis. Mercury concentrations down to 0.1 ppM were determined instrumentally via the isotopes ^{197}Hg (T = 65 h) and ^{203}Hg (T = 47 d). A high-resolution Ge(Li) detector was used in measuring the activity and a small computer for data reduction. Up to 500 samples were measured daily. Chemical separations were performed on samples with low mercury concentrations. Sensitivity of 0.01 ppM was attained by precipitating HgS from basic solutions and counting ^{197}Hg on NaI(Tl) detector. A new rapid instrumental method was also developed based on ^{199m}Hg (T = 43 min). This short-lived isotope was activated with resonance neutrons. The sensitivity of the method is 0.5 μg and it requires only 1 hr. (auth)

6918 DETERMINATION OF ^{227}Ac IN GEOLOGICAL MATERIALS THROUGH NEUTRON ACTIVATION AND α: SPECTROMETRIC ASSAY OF INDUCED ^{228}Th. Aly, H. F.; Herpers, U.; Herr, W. (Univ., Cologne). J. Radioanal. Chem.; 26: No. 2, 279-287(1975).

A new route has been developed for the micro-determination of ^{227}Ac in geological materials by neutron activation. The method is based on intense neutron irradiation of the analyzed samples followed by separation and α-spectrometric determination of ^{228}Th, the β-decay product of the 6.1 hr ^{228}Ac isotope formed. Two alternatives are considered for analysis related to the origin of the analyzed matrix. The high sensitivity of the method is documented by the determination of 10^{-17} g ^{227}Ac/g sample. The method is successfully applied for age determination of five uranium containing materials and old uranium glass from Bohemia, CSSR. (auth)

6919 SYNTHETIC MULTIELEMENT STANDARDS USED FOR INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS AS ROCK IMITATIONS. Leypunskaya, D. I. (Inst. of Nuclear Geophysics and Geochemistry, Moscow); Drynkin, V. I.; Belenky, B. V.; Kolomi'tsev, M. A.; Dundua, V. Yu.; Pachulia, N. V. J. Radioanal. Chem.; 26: No. 2, 293-304(1975).

Complex (multielemental) standards representing microelement composition of standard rocks such as trap ST-1 (USSR), gabbrodiorite SGD-1 (USSR), albitized granite SG-1 (USSR), basalt BCR-1 (USA) and granodiorite GSP-1 (USA) have been synthesized. It has been shown that the concentration of each microelement in the synthetic standards can be given with a high precision. Comparative investigation has been carried out of the synthetic imitations and the above natural standard rocks. It has been found that the result of the instrumental neutron activation analysis using the synthetic standards is as good as in the case when natural standard rocks are used. The results obtained have been also used for sub-

stantiation of the versatility of the method used for standard preparation, i.e. a generalization has been made of a possibility of using this method for the preparation of synthetic standards representing the microelement composition of any natural rocks with various compositions and concentrations of microelements. (auth)

6920 DETERMINATION OF URANIUM, ANTIMONY, INDIUM, BROMINE, AND COBALT IN ATMOSPHERIC AEROSOLS USING EPITHERMAL NEUTRON ACTIVATION AND A LOW-ENERGY PHOTON DETECTOR. Janssens, M.; Desmet, B.; Dams, R.; Hoste, J. (Univ., Ghent). J. Radioanal. Chem.; 26: No. 2, 305-315(1975).

Owing to the high ratio of resonance integral to thermal neutron activation cross-section of ^{238}U, a 5-min epithermal neutron irradiation under cadmium shielding, followed by measurement of the 74-keV photopeak of ^{239}U with a high resolution low-energy photon Ge(Li) detector, allows the fast determination of uranium in aerosols collected on a Whatman 41 cellulose filter. Uranium blanks of the cellulose filter paper require correction and limit the sensitivity. Simultaneously the concentrations of the elements cobalt, bromine, antimony and indium can be determined. In Belgium, the uranium concentrations of the aerosols were found to be constant and comparable to the uranium contents of rocks. (auth)

6921 DETERMINATION OF GOLD AND ARSENIC IN INDIAN TOBACCO LEAVES. Purkayastha, B. C.; Bhattacharyya, D. K. (Saha Inst. of Nuclear Physics, Calcutta). Radiochem. Radioanal. Lett.; 23: No. 1, 43-47(15 Oct 1975).

Two varieties of Indian tobacco leaves have been analyzed for gold and arsenic by neutron activation. Nicotiana rustica variety from North Bengal was found to contain 3.7×10^{-1} ppM of gold and 4.0×10^{-3} ppM of arsenic and the nicotiana tabaccum variety from Andhra Pradesh contains 1.26×10^{-1} ppM of gold and 5.1×10^{-3} ppM of arsenic, respectively. Unlike those in other countries Indian tobacco leaves seem to be enriched in the gold content and depleted in the arsenic content. The soil of North Bengal is richer in gold than the soil of Andhra Pradesh which requires further investigation, and the amount of arsenic in both soils is physiologically insignificant. (auth)

6922 NEUTRON ACTIVATION ANALYSIS OF HIGH-PURITY SILVER USING HIGH-RESOLUTION γ-SPECTROMETRY. Gilbert, E. N. (Inst. of Hydrometallurgy of Nonferrous Metals, Novosibirsk, USSR); Verlovkin, G. V.; Botchkaryov, B. N.; Godovikov, A. A.; Mikhailov, V. A.; Zhavoronkov, V. Ya. J. Radioanal. Chem.; 26: No. 2, 253-260(1975).

A method of neutron activation determination of microimpurities in high-purity silver has been developed. For matrix activity separation the extraction of silver by dibutyl-sulfide (DBS) was employed. The purification coefficient was 10^5 after triple extraction. Using Ge(Li) detector it was possible to determine 30 elements simultaneously in silver samples. (auth)

6923 RAPID SEPARATION OF MAGNESIUM-27 FROM A MATRIX OF ACTIVATED IRON. Peters, J. M.; Del Fiore, G. (Univ., Liege). Radiochem. Radioanal. Lett.; 23: No. 1, 5-18 (15 Oct 1975).

Using a 5-cm column of Dowex 50W X12 resin and the mixed solvent: 12M aqueous hydrochloric acid (10% V) – acetone (90% V), we could separate ^{27}Mg from an iron(Al) matrice activated with 14-MeV neutrons, in less than seven minutes. A slight modification consists in previously charging acetone with gaseous HCl. ^{27}Mg remains on the column, while the iron matrice and the interfering traces of ^{56}Mn and ^{53}Fe are eluted. This extremely rapid separation of ^{27}Mg could be applied to the activation analysis of aluminium traces in steels, using 14-MeV neutrons. (auth)

6924 RECENT DEVELOPMENT OF SUBSTOICHIOMETRY IN TRACE ANALYSIS. Kudo, K.; Suzuki, N. (Nippon Telegraph and Telephone Public Corp., Tokai). J. Radioanal. Chem.; 26: No. 2, 327-373(1975).

A review of the substoichiometry in trace analysis is presented. The principle of the method, practical applications and recent developments are described. (auth)

6925 OPTIMIZATION OF FIREARM RESIDUE DETECTION BY NEUTRON ACTIVATION ANALYSIS. Rudzitis, E. (Illinois Bureau of Identification, Joliet); Kopins, M.; Wahlgren, M. J. Forensic Sci.; 18: 93-100(1972).

From annual meeting of the Academy of Forensic Services, Las Vegas, NV (22 Feb 1973).

An investigation of the chemistry and radiochemistry involved in firearm discharge residue detection has been carried out. The usefulness of internal standards was demonstrated. The details and pitfalls were pointed out for the benefit of the novice worker planning to acquire neutron activation analysis capability. It is hoped that this investigation will receive constructive criticism from the experienced workers in the field and hopefully serve as the beginning of a uniform radiochemical procedure for the detection of firearm residue. (auth)

6926 APPLICATION OF ACTIVATION ANALYSIS FOR DETERMINATION OF IMPURITIES IN TUNGSTEN. Salamon, A. Acta Tech. Acad. Sci. Hung.; 78: No. 3-4, 427-434(1974).

The determination of the impurity content of W by activation analysis is described. The effect of the W matrix is discussed. Activation analysis was highly sensitive to most of the trace elements investigated. (Metals Abstr.)

6927 DETERMINATION OF LITHIUM, BORON, AND CARBON BY QUASI-PROMPT CHARGED PARTICLE ACTIVATION ANALYSIS. McGinley, J. R.; Schweikert, E. A. (Texas A and M Univ., College Station). Anal. Chem.; 47: No. 14, 2403-2407(Dec 1975).

A novel approach for rapid nondestructive trace analysis is presented, based on the detection of short-lived high energy beta emitters (10 msec less than or equal to t/sub 1/2/ less than or equal to 1 sec) produced by charged particle bombardment. Lithium, boron, and carbon were determined via $^{7}Li(d,p)^{3}Li$, $^{11}B(d,p)^{12}B$ and $^{12}C(p,n)^{12}N$, respectively. These elements were measured at the 1- to 350-ppM level with a relative precision of 5 to 30 percent in glasses, semiconductor materials, botanical specimens, and metals. Experimental detection limits are 0.50 ppM for lithium, boron, and 50 ppM for carbon. (auth)

Chemical and Spectral Procedures

Refer also to abstracts 6996, 7008, 7274, 7355, 7653, and 7904.

6928 (KAPL-P--4041) FACTORS THAT INFLUENCE AN ELEMENTAL DEPTH CONCENTRATION PROFILE. McHugh, J. A. (Knolls Atomic Power Lab., Schenectady, N. Y. (USA)). 1975. 11p. (CONF-751054--1). Dep. NTIS $4.50.

From mass spec seminar; Honolulu, Hawaii, USA (13 Oct 1975).

The use of secondary ion mass spectrometry in concentration profiling is discussed. Two classes of factors that influence an elemental concentration profile are instrumental effects and ion-matrix effects. Instrumental factors that must be considered are: (1) uniformity of the primary ion current density, (2) constancy of the primary ion current, (3) redeposition, (4) memory, (5) primary ion beam tailing and the nonfocused component, (6) chemical purity of the primary ion beam, and (7) residual gas impurities. Factors which can be classified as ion matrix effects are: (1) the mean escape depth of secondary ions, (2) recoil implantation, (3) molecular ion interferences, (4) primary ion beam induced diffusion of matrix species, (5) nonuniform sputter removal of matrix layers, and (6) implanted primary ion chemical and lattice damage effects. (LK)

6929 (KFK-2192) METHOD OF SEPARATING FISSION PRODUCT ELEMENTS, ACTINIDES, AND ALUMINUM BY MEANS OF ION EXCHANGE. Krause, W. J. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie). Jul 1975. 38p. (In German). Dep. NTIS (US Sales Only) $5.00.

A separation method based on ion exchange was developed to determine the isotope concentration of fission product elements in submicrogram amounts and of actinides in the lower milligram range using mass spectrometric isotopic dilution. Two anion and two cation exchange columns will be used. The fission products and the actinides will be isolated separately or in groups. A simplification of the separating method saves one cation exchange column. For fission product amounts in the lower nanogram range, also an anion exchange column can be omitted, since some of the elements separated in this column cannot be determined quantitatively. A guide for the separation of the fission product elements and actinides is given in the appendix. Experimental difficulties and improvements in separation are indicated. (auth)

6930 (ORNL-NSF-EATC--15) ENVIRONMENTAL APPLICATIONS OF THE CENTRIFUGAL FAST ANALYZER. Goldstein, G.; Strain, J.E.; Bowling, J.L. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 22p. Dep. NTIS $5.00.

The centrifugal fast analyzer (GeMSAEC Fast Analyzer) was applied to the analysis of pollutants in air and water. Since data acquisition and processing are computer controlled, considerable effort went into devising appropriate software. A modified version of the standard FOCAL interpreter was developed which includes special machine language functions for data timing, acquisition, and storage, and also permits chaining together of programs stored on a disk. Programs were written and experi-

mental procedures developed to implement spectrophotometric, turbidimetric, kinetic (including initial-rate, fixed-time, and variable-time techniques), and chemiluminescence methods of analysis. Analytical methods were developed for the following elements and compounds: SO_2, O_3, Ca, Cr, Cu, Fe, Mg, Se(IV), Zn, Cl^-, I^-, NO_2^-, PO_4^{-3}, S^{-2}, and SO_4^{-2}. In many cases, standard methods could be adapted to the centrifugal analyzer, in others new methods were employed. In general, analyses performed with the centrifugal fast analyzer were faster, more precise, and more accurate than with conventional instrumentation. (auth)

6931 (RDT-F-11-3T(9-75)) ANALYTICAL CHEMISTRY METHODS FOR METALLIC CORE COMPONENTS. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Reactor Research and Development). Sep 1975. 56p. RSO.

This standard provides analytical chemistry methods for the analysis of alloys used to fabricate core components. These alloys are 302, 308, 316, 316-Ti, and 321 stainless steels and 600 and 718 Inconels and they may include other 300-series stainless steels. (auth)

6932 INVESTIGATION OF THE PLUTONIUM CONTENT IN FISSION PRODUCT ^{99}Mo–^{99m}Tc GENERATORS. Sodd, V. J. (Cincinnati General Hospital); Grant, R. J.; Montgomery, D. M. Health Phys.; 29: No. 3, 425-427(Sep 1975).

^{99m}Tc eluates from 12 commercially available fission product ^{99}Mo generators nominally rated to contain 200 to 400 mCi of ^{99}Mo have been analyzed for plutonium contamination. The results show no detectable or significant amounts of plutonium in the ^{99m}Tc and thus no health hazard is involved. (UK)

6933 APPLICATION OF X-RAY PRODUCTION BY CHARGED PARTICLES TO ELEMENTAL ANALYSIS. Deconninck, G.; Demortier, G.; Bodart, F. (Universitaires Notre-Dame de la Paix, Namur, Belgium). At. Energy Rev.; 13: No. 2, 367-412 (Jun 1975).

A summary of analytical capabilities of the production of x radiation by charged particle bombardment is presented. Experimental results on cross-sections obtained during systematic measurements of many nuclei are tabulated. Intensities of x rays emitted during bombardment by charged particles of thin and thick targets are discussed in the scope of analytical applications. This method allows a local analysis and can be characterized by a high sensitivity for elemental analysis from aluminium to uranium. (auth)

6934 GRAVIMETRIC DETERMINATION OF LANTHANUM WITH N-p-CHLOROPHENYL-m-NITROBENZOHYDROXAMIC ACID. Khadikar, P. V.; Maru, P. C.; Verma, P. C. (Vikram Univ., Ujjain, India). Curr. Sci. (India); 44: No. 20, 736(20 Oct 1975).

A successful quantitative gravimetric determination of lanthanum was made in the presence of several metal ions with N-p-chlorophenyl-m-nitrobenzohydroxamic acid. The lanthanum forms canary yellow granular complex at pH 7.3 to 8.8 and the composition of the complex was found to be $[C_{13}H_8O_4N_2Cl]_3$ La. [LK]

6935 POLAROGRAPHIC DETERMINATION OF URANIUM(VI) IN AQUEOUS TRI-N-BUTYL PHOSPHATE SOLUTIONS. Shabana, R.; Hafez, F. (Atomic Energy Establishment, Cairo). J. Radioanal. Chem.; 27: No. 1, 25-31(1975).

The effect of TBP as well as the organic diluents on the polarographic wave of U(VI) reduction has been investigated in sulfuric and perchloric acids. It was found that the presence of TBP traces in the solution to be analyzed induced another wave which was more prominent in sulfuric acid solutions. This can be eliminated by boiling the solution for about 5 min before their analysis for uranium. The effect of supporting electrolyte on the polarographic reduction of U(VI) was also studied and the use of 6N $HClO_4$ was recommended. (auth)

6936 COMPLEXES OF BERYLLIUM WITH FIVE- AND SIX-MEMBERED CHELATE RINGS. Votava, J.; Bartusek, M. (Purkyne Univ., Brno). Collect. Czech. Chem. Commun.; 40: No. 70, 2050-2058(Jul 1975).

Complexes of Be(II) with malonic and oxalic acids and with NTA, NTP and EDTA were studied using potentiometric acid-base titrations. The stability constants obtained indicate that ligands forming six-membered chelate rings yield more stable complexes with Be(II) than homologous ligands forming five-membered rings. The use of NTP for the alkalimetric determination of Be(II) has been proposed. (auth)

6937 MEMORY EFFECT IN THE MASS-SPECTROMETRIC MEASUREMENT OF THE ISOTOPIC COMPOSITION OF IRON FROM ITS PENTACARBONYL. Shadskii, I. P. (Moscow Inst. of the Petroleum-, Chemical-, and Gas Industry). Russ. J. Phys. Chem. (Engl. Transl.); 49: No. 1, 28-30(Jan 1075).

Translated from Zh. Fiz. Khim.; 49: No. 1, 52-55(Jan 1975).

Three features have been established in precision mass-spectrometric measurements of the isotopic composition of iron in the pentacarbonyl: firstly, a carbonyl layer is formed on the internal surface of the admission system, and may cause during the measurements mass peaks comparable in intensity with the working peaks; secondly, an increase in the residual background is observed during the alternating admission of iron pentacarbonyl to the ion source; and thirdly, the rate of fall in intensity of the peaks corresponding to iron ions increases with the time of operation of the admission system. Possibilities of diminishing the memory effect on the measurements are considered. (auth)

6938 DETERMINATION OF TOTAL TRACE RARE EARTH ELEMENTS IN NICKEL–IRON BASE ALLOYS BY SODIUM HYDROXIDE PRECIPITATION SEPARATION AZOARSINE III COLORIMETRY. Hua Hseuh Tung Pao; No. 1, 15-19(23 Jan 1975).

Using cerium to represent the rare earth elements in the experiments, a colorimetric method for the determination of trace rare earth elements in nickel-iron base alloys was developed based on sodium hydroxide precipitation separation of rare earth elements, and azoarsine III colorimetry. To cope with interference, EDTA-zinc is used to mask iron, sulfosalicylic acid to mask aluminum, mendalic acid to mask titanium, ethylene diamine to mask nickel, cobalt and copper, and an alkaline to convert Cr^{3+} to Cr^{6+}. The rare earth recovery is more than 90%. The method has proved to be simple, accurate and stable, and is suitable to analysis of more than 0.001% rare earth elements in all types of nickel-iron base alloys. (JPRS)

6939 SPECTROSCOPIC DETERMINATION OF LOW NIOBIUM CONTENTS IN HIGH-ALLOY STEELS. Goryczka, J. Chem. Anal. (Warsaw); 19: No. 5, 949-961(1974). (In German).

Nb contents of 0.003 to 0.6 percent in medium- and high-alloy C steels may be determined using high-voltage excitation parameters of 12 kV, 600 pF and O mhenrys. Corrections are made for background effects. For high-alloy steels, an ancillary Fe electrode is used to eliminate the effects of the Fe and alloying elements in the steel. The standard deviation of the results is less than +-0.002 percent Nb for a Nb content of 0.02 percent. (Metals Abstr.)

6940 DETERMINATION OF TIN, ANTIMONY, AND TANTALUM IN THE PRESENCE OF PRECIOUS METALS BY ATOMIC ABSORPTION SPECTROSCOPY. Harrinton, D. E.; Bramstedt, W. R. At. Absorpt. Newsl.; 14: No. 2, 36-38(1975).

Coatings of Sn, Sb, or Ta oxides, in conjunction with precious metal oxides, on a Ti substrate are used as industrial electrochemical catalysts. These oxides are stripped from the substrate by alkali fusion and brought into solution by acid digestion. Tantalum is isolated by extraction into MIBK and determined by atomic absorption spectroscopy. Tin and Sb are determined directly. Possible interferences are examined. Recovery experiments for each element following the alkali fusion procedure yielded 95 percent recovery of Sb and Sn, 85 percent recovery of Ta. (Metals Abstr.)

6941 SPECTROPHOTOMETRIC DETERMINATION OF IODIDE AND IODINE AT PARTS-PER-MILLION LEVEL AS A THIOCYANATE COMPLEX. Clark, B. R. (Oak Ridge National Lab., TN); Skoog, D. A. Anal. Chem.; 47: No. 14, 2458-1460 (Dec 1975).

A simple method is described for the determination of iodide or iodine in aqueous solutions by the generation and photometric measurement of an iodine thiocyanate complex, $I(SCN)_2^-$, in the presence of excess hydrogen peroxide. Because other halides do not produce serious interferences when present in excesses of several thousandfold, separation from these anions can be avoided in many natural samples. The transition metal ions interfered to varying extents. It is suggested that pretreatment of natural samples with a cation exchange resin could remove interfering cations to acceptable levels. (JGB)

6942 X-RAY EXCITED-OPTICAL LUMINESCENCE OF LANTHANIDES IN PHOSPHORS PREPARED FROM YTTRIUM OXIDE AND IRON TRANSITION-GROUP OXIDES: APPLICATION TO THE DETERMINATION OF LANTHANIDES IN IRON AND ITS ALLOYS. DeKalb, E. L.; Fassel, V. A. (Ames Lab., IA). Anal. Chem.; 47: No. 14, 2354-2356(Dec 1975).

A series of new phosphors was prepared using yttrium oxide and the oxides of the iron transition group elements. These phosphors when excited by x-ray radiation are strongly luminescent in the visible spectral region if the oxides of the iron-group

oxides contain lanthanide elements. These phosphors were used for the determination of several lanthanides at the ppM level in iron and several of its alloys. Results of the determination of Ce, Pr, Nd, and Sm in low alloy steel are given. (auth)

6943 SPECTROPHOTOMETRIC–ISOTOPE DILUTION DETERMINATION OF ARSENIC IN SOILS AND ROCKS. Brown, F. W.; Simon, F. O.; Greenland, L. P. J. Res. U. S. Geol. Surv.; 3: No. 2, 187-190(1975).

Arsenic in soil and rock samples may be determined in part-per-million concentrations using a radiochemical-isotope dilution method. Arsenic in the sample plus added ^{76}As tracer is separated as arsine and determined spectrophotometrically as a molybdenum blue complex. The ^{76}As activity in the absorbing solution allows corrections for chemical losses. A lower limit of 1 ppm is determinable in a 0.5-g sample. (auth)

6944 ANALYSIS FOR TELLURIUM IN ROCKS TO 5 PARTS PER BILLION. Watterson, J. R.; Neuerburg, G. J. J. Res. U.S. Geol. Surv.; 3: No. 2, 191-195(1975).

In the proposed method, a 12.5-g sample is digested with nitric acid and evaporated to dryness; the excess nitric acid is removed by reaction with formic acid. Tellurium is extracted from the dried residue into hydrobromic acid and is then coprecipitated with arsenic, using hypophosphorous acid as the reducing agent. The precipitate is dissolved in a solution of hydrobromic acid and bromine, from which the tellurium is extracted into 0.6 ml of methyl isobutyl ketone. Tellurium content is estimated by atomic absorption spectrophotometry. Recovery of tellurium from nitric acid solutions carried through the procedure approached 100 percent through the analytical range 5 to 200 ppb. The relative standard deviation of five consecutive analyses of USGS standard rock GSP-1 was 5.26 percent at a mean concentration of 20.8 ppb. Under optimum conditions an average of 20 samples may be analyzed per man-day. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 7415, 7722, and 8190.

6945 SPRAVOCHNIK PO RADIOMETRICHESKOI RAZVEDKE I RADIOMETRICHESKOMY ANALIZU. (Handbook of Radiometric Surveying and Radiometric Analysis). Prutkina, M. I.; Shashkin, V. L. Moscow; Atomizdat (1975). 248p.

Handbook data are presented on the natural radioactive elements and on the ionizing radiations necessary for practical work. Methods of counting ionizing radiations are described, and basic data are given on radiation detectors used in radiometry. A detailed presentation is given on the basic data of gamma spectra for a large number of uranium and thorium ores. A large part of the handbook consists of a brief presentation of the characteristics of radiometric methods accompanied by factual material necessary for practical work (formulas, tables and graphs). A look is taken at analyzing ore samples by beta- and gamma-radiation, the spectrometric gamma method, emanation methods of determining radium isotopes and emanation coefficients of ores, the alpha-spectrometric method for the isotopic analysis of uranium in ores and field survey methods by foot, air, or borehole surveying. (125 tables, 61 figures, 80 references) (SJR)

6946 DETERMINATION OF THALLIUM BY ISOTROPIC DILUTION METHOD USING SUBSTOICHIOMETRIC DISPLACEMENT. Adamek, A.; Chiriatev, M. N. (Joint Inst. of Nuclear Research, Dubna, USSR). J. Radioanal. Chem.; 26: No. 1, 56-61 (1975).

A new analytical procedure for the determination of thallium in a wide concentration range has been developed. The method of direct isotopic dilution (IDA) using carrier-free ^{202}Tl and the formerly developed procedure of substoichiometric displacement have been used for the determination of thallium content in various types of analyzed samples e.g. minerals, sediments, ion-exchangers, hydrothermal waters, in the concentration range from several percent to 10^{-4}%, or subsequently down to 0.01 μg/ml in waters. The results obtained are compared with those of emission spectrometry and activation analysis using (γ,n) reaction. A good agreement was found. (auth)

6947 RADIO THIN LAYER CHROMATOGRAPHIC TRACE DETERMINATION OF DITHIONIC ACID. Schoenherr, S.; Goerz, H.; Ackermann, G. (Sektion Chemie der Bergakademie, Freiberg, Ger.). J. Radioanal. Chem.; 26: No. 1, 73-77(1975). (In German)

A modified method of isotope dilution analysis is described for the determination of small amounts of dithionic acid (1 to 10 μg). The conditions for the setting up of the calibration curve are reported. The inactive dithionic acid is labelled with ^{35}S compound. After separation by thin layer chromatography on extremely thin layers the activity profiles of the spots are measured. The reduced maximal intensities are plotted against the amount of dithionic acid. The calibration curve is also valid for solutions containing up to 1M of sulfuric acid. (auth)

6948 APPARATUS FOR THE MEASUREMENT OF RAPID VARIATIONS OF THE EMISSION OF A RADIOACTIVE GAS BY A SOLID EXPOSED TO THERMAL PROCESSING UNDER CONTROLLED ATMOSPHERE. Quet, C.; Bussiere, P. (CNRS, Villeurbanne, France). J. Radioanal. Chem.; 27: No. 1, 5-14 (1975). (In French).

An apparatus is described that enabled us to carry out a quantitative kinetic investigation of rather quick physicochemical transformations of divided solids by means of an emission of radioactive gas, as in the emanation method. Especially the details of the reaction cells are given in which surface area measurements by the BET method are also performed, and of the low volume scintillation chamber. Its high efficiency does not depend on the nature of the gas. The diverse components of the device ensure a good quality of pure atmosphere or vacuum, rapid and precise temperature setting and control, and reproducible sweeping of the radioactive gas escaping from the sample. (auth)

6949 EFFECT OF POLYETHYLENE VIAL ON INSTABILITY OF LIQUID SCINTILLATION MEASUREMENTS DUE TO SAMPLE SORPTION. Tykva, R.; Podracka, E. (Inst. of Organic Chemistry and Biochemistry, Praque). Radiochem. Radioanal. Lett.; 23: No. 1, 25-32(15 Oct 1975).

In polyethylene vials, instability is examined of the liquid scintillation measurement due to sorption of the sample with the use of carrier-free sodium [^{32}P] orthophosphate. Changes in amplitude spectra are analyzed on a liquid scintillation spectrometer by the differential as well as integral techniques in the appropriate counting channels. When compared with glass vials, polyethylene shows more pronounced changes of counting rates in ^{32}P- and ^{3}H- channels whereas the time dependence values of a vial set are markedly less scattered in the case of polyethylene vials. The cause of differences between polyethylene and glass vials is discussed. (auth)

6950 RAPID RADIOCHEMICAL SEPARATION OF SELECTED TOXIC ELEMENTS IN ENVIRONMENTAL SAMPLES PRIOR TO GAMMA RAY SPECTROMETRY. Wilshire, F. W.; Lambert, J. P.; Butler, F. E. (Quality Assurance and Environmental Monitoring Lab., Research Triangle Park, NC). Anal. Chem.; 47: No. 14, 2399-2403(Dec 1975).

Toxic elements in a variety of environmental samples are activated by neutron bombardment for subsequent analysis by gamma spectrometry. The radioactive isotopes of arsenic, cadmium, mercury, selenium, iodine, and zinc are chemically separated by using the liquid anion exchanger, triisooctylamine, following sample combustion. Significant improvements over currently used procedures are: a radiochemical separation that is quantitative in that all of the products trapped during combustion are contained in one of three sample fractions; an isolation of elements of interest from those elements with interfering gamma energies; a procedure that has few chemical manipulations, thus minimizing related errors; a separation that is simple and requires less than 5 minutes to complete following combustion. In addition, the elements contained in liquid samples can be separated directly by liquid anion exchange, eliminating the combustion procedure. The methodology was tested by radiotracer experiments and by analyzing independently tested and certified coal and fly-ash samples. (auth)

Separation Procedures

Refer also to abstract 7395.

6951 RADIOCHEMICAL SEPARATION OF RARE EARTHS BY RETENTION ON LANTHANUM OXALATE. Csajka, M. (Central Research Inst. for Physics, Budapest). J. Radioanal. Chem.; 26: No. 1, 79-85(1975).

Investigations have been made on the limit quantities of the applicability of lanthanum oxalate for the practically total retention of rare earth activities under given conditions of radiochemical group separation. The variation of the activity retention was studied by increasing the concentration of the investigated rare earth ions in the solution. The effect of the presence of another than the retained rare earth activity in the solution was also observed. Finally, the retention of scandium activity under the same conditions as those used for the rare earths was investigated. (auth)

6952 EXTRACTION OF MINERAL ACIDS AND URANIUM FROM ALCOHOLIC AND ACETONIC SOLUTIONS WITH TRI-N-BUTYL PHOSPHATE. Shabana, R.; Hafez, F. (Atomic Energy Establishment, Cairo). J. Radioanal. Chem.; 26: No. 1, 63-71 (1975).

The extraction of hydrochloric, nitric, and sulfuric acids with TBP was studied as a function of methanol, ethanol, isopropanol, and acetone concentration in the aqueous phase. Extraction increases in the order: methanol < ethanol < acetone < isopropanol. Uranium extraction with TBP was studied also as a function of the concentration of alcohols and acetone from hydrochloric as well as nitric acid media. Extraction of uranium from both acids increases with the increase of acetone concentration and the decrease of alcohol concentration. The dependence of the extraction of acids and uranium on the concentration of TBP was also studied. (auth)

6953 SOLVENT EXTRACTION EXPERIMENTS WITH TRIVALENT URANIUM AND NEPTUNIUM. Bullock, J. I.; King, M. E. (Surrey Univ., Guildford, Eng.). Inorg. Nucl. Chem. Lett.; 11: No. 9, 605-610(Sep 1975).

A report is presented on experiments directed towards the extraction of trivalent uranium and neptunium from aqueous solutions, as thiocyanate or citrate complexes, into TBP, TOPO etc. in the organic phase. It had been found previously that some oxidation occurred even though oxygen was excluded and was rapid in air. In the present work, all experiments with the trivalent metal ions were carried out in nitrogen atmospheres, but oxidation was still a problem. Results are also presented for the extraction of tetravalent uranium and neptunium from aqueous acid thiocyanate solution into TBP in hexane. Figures are included showing spectroscopic data. (UK)

6954 EXTRACTION OF CESIUM AND STRONTIUM INTO NITROBENZENE IN THE PRESENCE OF ARSENIC ACID–CATECHOL COMPLEX. Krtil, J.; Rais, J. (Inst. of Nuclear Research, Rez, Czech.). J. Radioanal. Chem.; 27: No. 1, 47-55(1975).

The extraction of Cs and Sr into nitrobenzene in the presence of complex of arsenic acid and catechol is described. The dependence of distribution ratio of Cs and Sr on the concentration of HNO_3, NH_4NO_3, $NaNO_3$, and the reagent concentration were determined. On the basis of these results a probable mechanism of Cs and Sr extraction was suggested. (auth)

6955 Tc–Mo EXTRACTION BY TETRAPHENYL ARSONIUM FROM DIFFERENT MINERAL ACID SOLUTIONS. Souka, N.; Ali, A. S. (Atomic Energy Establishment, Cairo). J. Radioanal. Chem.; 26: No. 2, 271-277(1975).

A systematic investigation on ^{99m}Tc and ^{99}Mo extraction by $(C_6H_5)_4As^+$ from HCl, HBr, HNO_3, and H_2SO_4 solutions has been undertaken. Technetium extraction was found to attain very high values at low acid concentrations, while molybdenum has negligible extraction coefficients. Consequently, at low acidities, Tc could be separated from irradiated Mo with very high selectivity. TcO_4^- distribution coefficient was found to depend, however, on the nature and concentration of competing anions. For the same anion concentration, the selectivity of Tc extraction takes the sequence $SO_4^{2-} > Cl^- > Br^- > NO_3^-$. Experimental results enabled a calculation of stability constant of $(C_6H_5)_4AsTcO_4$. Extraction data were used to identify parameters for a ^{99m}Tc generator. (auth)

6956 UPTAKE OF PROTACTINIUM ON HYDROPHOBIC SILICA GEL FROM MIXED MEDIA. Caletka, R.; Spevackova, V. (Nuclear Research Inst., Rez, Czech.). Radiochem. Radioanal. Lett.; 23: No. 1, 37-42(15 Oct 1975).

The paper describes the uptake of protactinium on siliconized silica gel from mixed solutions of hydrochloric and lower aliphatic alcohols. The highest uptake was observed at 5-10 vol % alcohol in the solution. With the increasing molecular weight of the alcohol, the uptake of protactinium increases. On the basis of batch conditions, zirconium, niobium, and thorium were separated from protactinium. (auth)

6957 SEPARATION OF TRACE CONCENTRATIONS OF TANTALUM FROM NIOBIUM AND SOME OTHER HEAVY METAL IONS BY EXTRACTION WITH N-OXIDE OF TRIOCTYLAMINE. Ejaz, M. (Univ. of New South Wales, Kensington, New South Wales). J. Radioanal. Chem.; 27: No. 1, 67-75(1975).

The distribution of tantalum(V) between 0.1M trioctylamine oxide dissolved in xylene and sulfuric acid solutions has been studied. On the basis of results on the distribution, it is concluded that at sulfuric acid concentration 0.5M, tantalum is probably extracted by a solvate mechanism as the complex $Ta(OH)(SO_4)_2 \cdot 3$ TOAO. It has also been shown that tantalum can be quantitatively separated from niobium, uranium, thorium and rare earth elements by extraction with N-oxide of trioctylamine from 0.5M sulfuric acid solution. (auth)

6958 SORPTION OF ^{204}Tl(III) FROM HYDROCHLORIC ACID–WATER–ORGANIC SOLVENT MIXTURES ON DEAE-CELLULOSE. Fisel, S.; Bilba, D.; Cecal, A. (Polytechnical Inst., Jassy, Romania). J. Radioanal. Chem.; 27: No. 1, 89-94(1975).

The distribution coefficients of ^{204}Tl(III) between DEAE-cellulose and HCl–water–organic solvent (alcohols and ketones) mixtures have been determined using the statical method. The hydrochloric acid concentration as well as the nature and concentration of organic solvent in the mixtures have been widely varied. Sorption of Tl(III) takes place through a combined process of ion exchange and physical adsorption, its distribution between the anionic cellulose and solvent mixture depends on the tendency of the ionic association formation in these media. (auth)

6959 USE OF TRI-N-OCTYLAMINE FOR THE SEPARATION OF VANADIUM(V) FROM ACIDIC SULFATE URANIUM LEACH LIQUORS. Rusheed, A.; Qazi, A. H.; Ahmad, S.; Ashraf, M. (Pakistan Inst. of Nuclear Science and Tech., Rawalpindi). Sep. Sci.; 10: No. 4, 507-515(1975).

Extraction of vanadium(V) from acidic sulfate solutions by a mixture of tri-n-oxtylamine and tributylphosphate (used as modifier) dissolved in kerosene has been studied. The distribution coefficient of vanadium(V) increases with an increase in pH and vanadium(V) concentration. The presence of iron(III) in aqueous solution does not have any appreciable effect, while large amounts of sulfate ion depress the distribution coefficient. Uranium(VI) has a distribution different from vanadium(V). Based upon these results, a scheme for the separation of vanadium(V) from uranium leach liquors has been made and checked experimentally. (auth)

6960 EXTRACTION SEPARATION STUDIES OF URANIUM(VI) BY AMINE OXIDES. Ejaz, M. (Pakistan Inst. of Nuclear Science and Tech., Rawalpindi). Sep. Sci.; 10: No. 4, 425-446(1975).

The extraction of uranium(VI) by two amine oxides, 4-(5-nonyl)-pyridine oxide and trioctylamine oxide has been studied. The extraction behavior of these two N-oxides is compared. The dependence of extraction on the type of amine oxide and acid, nature of organic diluent, and amine oxide concentration has been investigated. The influence of the concentration of the metal and salting-out agents is described. The possible mechanism of extraction is discussed in the light of the results of extraction isotherms, loading radiodata, and log-log plots of amine oxide concentration vs distribution ratio. The separation factors for a number of metal ions are reported, and the separation of uranium from some fission elements has also been achieved. (auth)

Inorganic, Organic, and Physical Chemistry

Chemical and Physicochemical Properties

Refer also to abstracts 7001, 7725, 7762, 7775, 7776, and 7840.

Isotope Effects

Refer also to abstract 6987.

6961 EFFECT OF THE DEVIATION FROM STOICHIOMETRY ON CATION SELF-DIFFUSION AND ISOTOPE EFFECT IN WUESTITE, $Fe_{1-x}O$. Chen, W. K.; Peterson, N. L. (Argonne National Lab., IL). J. Phys. Chem. Solids; 36: No. 10, 1097-1103(Oct 1975).

Diffusion of ^{59}Fe in $Fe_{1-x}O$ crystals has been measured by a serial-sectioning technique as a function of temperature and deviation from stoichiometry. The results indicate that the diffusivity increases slightly at 1200°C, decreases at 802°C with an increase in x, and is insensitive to change in x at 1003°C. The temperature dependence of the cation diffusivity in $Fe_{0.94}O$ is given by the expression, $D = (8.6 \pm 0.5) \times 10^{-3} \exp(-29350 \pm 300/RT)$ cm^2/sec, in the temperature range 700 to 1340°C. The isotope effect for cation self-diffusion was measured by simultaneous diffusion of ^{52}Fe and ^{59}Fe in $Fe_{1-x}O$ at various temperatures and values of x. Although the measured values of $f\Delta K$ are independent of temperature within the limits of experimental error, they decrease with an increase in the deviation from stoichiometry. The experimental results appeared to be consistent

with the diffusion of Fe ions via "free mobile vacancies" that coexist with defect clusters. As a consequence of a "site-blocking" effect, the mobility of "free mobile vacancies" and the apparent correlation factor for cation tracer diffusion decrease with an increase in deviation from stoichiometry. (auth)

6962 APPLICATION OF IRREVERSIBLE THERMODYNAMICS TO ISOTOPIC DIFFUSION. I. Isotope–Isotope Coupling Coefficients for Ions and Water in Concentrated Aqueous Solutions of Alkali Metal Chlorides at 298.16°K. Anderson, J.; Paterson, R. (Glasgow Univ.). J. Chem. Soc. (London), Faraday Trans., I.; 71: 1335-1351(1975).

From literature sources irreversible thermodynamic parameters may be obtained for all alkali metal chloride salt solutions at 298.16°K in the concentration range 0 to 3.0 mol dm^{-3}. Comparable data for isotopic diffusion coefficients of component ions and water are incomplete. These have been obtained in this study, using a diaphragm cell, for all but rubidium ion in rubidium chloride. It is shown that these two sets of data may be combined to yield Onsager frictional coefficients (r_{ij}) or mobility coefficients (l_{ij}) which measure the kinetic interaction between isotopes as a function of concentration for each salt solution. Interpretation of l_{ij} for ions is made difficult because of large frame-of-reference contributions with water solvent, but these may be compared with values calculated from the Onsager limiting law. Frictional interpretations are more explicit. The main factor contributing to the experimental diffusion coefficient for ions, D_{ii}, remains ion-water friction which amounts to some 90% for many salts even at 3.0 mol dm^{-3}. The primary cause is that interionic friction between ions of opposite charge is largely cancelled by isotope-isotope friction in the expression for D_{ii}. Water diffusion, D_{00}, unlike the ionic case, is due primarily to isotope-isotope friction (between water and water) which is the sole contribution to D_{00} for pure water. These two components have been isolated for all salts and the effects of the solvation tendencies for different cations is clearly shown in variations of water-to-water friction in the more concentrated solutions. (auth)

6963 INVERSE ISOTOPE EFFECT ON THE RATE OF POLYMERIZATION OF DEUTERATED METHYL METHACRYLATE. Ayrey, G.; Wong, D. J. D. (Queen Elizabeth Coll., London). Polymer; 16: No. 8, 623(Aug 1975).

It is stated that there are relatively few reports on the effect of deuterium substitution on the rate of free radical polymerization. A preliminary report is presented on a radiochemical investigation of the polymerization of methyl methacrylate [$^2H_5$] [$CD_2 = C(CD_3)CO_2CH_3$]. The overall rate constant, k, for polymerization of the deuterated monomer is ~36% greater than that of the undeuterated monomer and the isotope effect $k_H/k_D = 0.73$. The increased rates of polymerization are also reflected in the higher molecular weights of the deuterated polymers. The results are discussed and possible mechanisms considered. (UK)

6964 DERIVATOGRAPHIC STUDIES ON DEHYDRATION OF SALT HYDRATES AND THEIR DEUTERIUM OXIDE ANALOGS. V. Chaudhuri, N. R.; Pathak, G. K. (Indian Association for the Cultivation of Science, Calcutta). Thermochim. Acta; 13: No. 1, 71-83(Sep 1975).

Nonisothermal thermal studies of the dehydration of the double salt hydrates of the type $M(D_2SO_4 \cdot M(II)SO_4 \cdot 6H_2O$ and their D_2O analogues were carried out where M(I) = Tl(I) and M(II) = Mg(II), Co(II), Ni(II), Cu(II) or Zn(II). Thermal parameters like activation energy, order of reaction, enthalpy change, etc. were evaluated from the analysis of TG, DTA, and DTG curves. These thermal parameters were compared with those of other series, like NH_4(I), K(I), Rb(I) and Cs(I) studied earlier. On deuteration the nature of dehydration altered in the case of $Tl_2Zn(SO_4)_2 \cdot 6H_2O$ only. The thermal stability of the salt hydrates and their D_2O analogues is discussed in relation to the salt hydrates of other series. The role of divalent cation on the thermal properties of dehydration of salt hydrates is also discussed. The order of reaction was always found unity. The values of ΔH were within ~12–~16 kcal $mole^{-1}$. (auth)

6965 ISOTOPE EFFECT IN THE PHOTOCHEMICAL REDUCTION OF AROMATIC NITRO-COMPOUNDS IN AQUEOUS ALCOHOLIC AND ALKALINE AQUEOUS ALCOHOLIC MEDIA. Kuznetsova, N. A.; El'tsov, A. V.; Fomin, G. V.; Frolov, A. N. (Leningrad Technological Inst.). Russ. J. Phys. Chem. (Engl. Transl.); 49: No. 1, 63-65(Jan 1975).

Translated from Zh. Fiz. Khim.; 49: No. 1, 115-118(Jan 1975).

The quantum yield in the photochemical reduction of dinitrobenzenes in aqueous alcohol depends on the nature of the alcohol and has an isotope effect $k_H/k_D \cong 2.6$. In alkaline aqueous alcohol the quantum yield increases with the concentration of alkali, but hardly changes on passing to a deuteriated solvent ($k_H/k_D \cong 1-1.4$). It is concluded that the photochemical reduction in alkaline media probably involves electron transfer in the primary step from the alkoxide anion and that its rate is limited by diffusion and not by the energy of the C–H bond as in the photochemical reduction of nitro-compounds via the photochemical dehydrogenation mechanism. (auth)

6966 ISOTOPE EFFECTS IN ENZYMATIC N-DEMETHYLATION OF TERTIARY AMINES. Abdel-Monem, M. M. (Univ. of Minnesota, Minneapolis). J. Med. Chem.; 18: No. 4, 427-430(Apr 1975).

The N-demethylation of 1-(N-methyl-N-trideuteriomethylamino)-3-phenylpropane (1) by rodent liver homogenates was studied. The ratio of 1-trideuteriomethylamino-3-phenylpropane (2)/1-methylamino-3-phenylpropane (3) was determined by gc-ms. The ratio of 2/3 in the product of N-demethylation of 1 by liver homogenate from phenobarbital-treated rats was 1.31 and from untreated rats was 1.32, and the differences between the two groups were not statistically significant. The ratio of 2/3 in the product obtained from N-demethylation of 1 by liver homogenates from mice was 1.45. The ratio of 2/3 of greater than unity indicates the presence of a kinetic primary isotope effect in the enzymatic N-demethylation reaction. The effect is exclusive of the secondary isotope effect on the amine nitrogen. The presence of this primary isotope effect indicates that the cleavage of the C–H bond of the N-methyl group is a rate-limiting step in the N-demethylation of tertiary amines by rodent microsomal enzymes. (auth)

Isotope Exchange and Isotope Separation

6967 (AECL-4929) INVESTIGATION OF A LABORATORY-SCALE BITHERMAL SYSTEM WITH ONCE-THROUGH FLUID FLOW. Marginean, P.; Mercea, I.; Mercea, V.; Olariu, A. Translated from Isotopenpraxis; 5: No. 4, (1969). 13p. Dep. NTIS (US Sales Only) $4.50.

A bithermal system with once-through fluid flow was investigated for the isotopic separation between hydrogen, water vapor and water. A linear relationship between deuterium and hydrogen concentrations in the gases and the liquid was found to exist. The possibility of experimentally estimating the actual values of column parameters is discussed. (auth)

6968 (SRO-854-4) GAS-CHROMATOGRAPHIC FRACTIONATIONS OF STABLE ISOTOPES OF CARBON AND OXYGEN IN CARBON DIOXIDE. Shepard, A. T.; Danielson, N. D.; Pauls, R. E.; Mahle, N. H.; Taylor, P. J.; Rogers, L. B. (Georgia Univ., Athens (USA). Dept. of Chemistry). 1975. 20p. Dep. NTIS $4.50.

A high-precision gas chromatograph was used in conjunction with a quadrupole mass spectrometer and an on-line computer to study the fractionation of carbon and oxygen isotopes in carbon dioxide on two solid adsorbents and on a variety of liquid phases. For adsorption studies, the relative retention is reported as a function of temperature on Porapak Q and silica gel. On the former, alpha values are on the order of 1.0027 +– 0.0001 (standard deviation) for the carbon isotopes and 1.0011 +– 0.0002 for the oxygen species, while on silica gel, the values are 1.0031 +– 0.0004 and 1.0050 +– 0.0008, respectively. Differential thermodynamic data are reported. Using diethanolamine and polyethylene imine columns in gas–liquid chromatography, greater fractionation was found. However, column bleed and decomposition of the liquid phase were serious problems. (auth)

6969 SEPARATION OF STABLE ISOTOPES AND THE PREPARATION OF LABELED COMPOUNDS WITH SPECIAL REFERENCE TO ^{13}C, ^{15}N, AND ^{18}O. Edmunds, A. O.; Lockhart, I. M. (British Oxygen Co. Ltd., London). pp 279-293 of Isotope Ratios as Pollutant Source and Behavior Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB–382; CONF-741120–.

Rapid progress in the development of instrumentation and the availability of labelled compounds has led to the widespread use of stable isotopes in tracer studies. Prochem has separation units for carbon-12 (up to 99.95 at. %) and carbon-13 (over 90 at. %) using cryogenic distillation of carbon monoxide, nitrogen-15 (up to 99.9 at. %) is separated by chemical exchange between oxides of nitrogen and nitric acid, and cryogenic distillation is being employed for the separation of oxygen-18 (up to 25 at. %). As a result of extensive experience and development, these plants operate continuously on a highly efficient basis. A chemical laboratory on the same site completes the unit and synthesizes a large range of compounds labelled with these isotopes. A variety of special techniques are employed arising in particular from the often unorthodox starting materials and the need to

conserve isotope. Among new developments, compounds are now being prepared with more than one species of isotope. Carbon-12 compounds are also being synthesized for possible use as "negative label." With such facilities available on one site, Prochem is probably better placed than any other Company to offer a complete service to users of stable isotopes. At the same time, the comprehensive nature of the operation is an important factor in keeping costs down. The speed of development of the use of stable isotopes will be increased with close co-operation between producer and user. (auth)

6970 SEPARATION OF SULFUR ISOTOPES BY LIQUID THERMAL DIFFUSION AND BY CHEMICAL EXCHANGE. Rutherford, W. M.; Roos, W. J. (Mound Lab., Miamisburg, OH). pp 295-304 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The application of separated sulphur isotopes as environmental tracers depends upon their cost. Sulphur isotopes can be separated in quantities of several kilograms per year by liquid thermal diffusion and by the SO_2-bisulphite chemical exchange process. Mound Laboratory is developing both of these processes. Some of the basic problems associated with liquid thermal diffusion have been solved, and an experimental cascade using carbon disulphide as the working fluid is now being used to separate small quantities of material enriched to more than 45 percent sulphur-34. Chemical exchange appears to be a better method of separating sulphur-34. A 5 column chemical exchange cascade using the bisulphite process is now being constructed. The chemical exchange system will be capable of producing 1.2 kg/a of sulphur at an enrichment of 90 percent sulphur-34. Because of the anticipated cost of sulphur isotopes, applications will be limited to small amounts of enriched material. Double tagging of selected compounds may increase the range of usefulness. (auth)

6971 SEQUENTIAL DEUTERIUM EXCHANGE REACTIONS OF PROTONATED BENZENES WITH D_2O IN THE GAS PHASE BY ION CYCLOTRON RESONANCE SPECTROSCOPY. Freiser, B. S.; Woodin, R. L.; Beauchamp, J. L. (California, Inst. of Tech., Pasadena). J. Am. Chem. Soc.; 97: No. 23, 6893-6894 (12 Nov 1975).

Results are reported on a novel deuterium exchange reaction, observed using ion cyclotron resonance (ICR) spectroscopy. In apparent contrast to previously reported results, sequential reactions of protonated aromatic compounds with D_2O in the gas phase occur which lead to various degrees of ring deuteration. For example, reactions in a mixture of benzene and D_2O produce $C_6H_6D^+$, which in further reaction with D_2O undergoes rapid stepwise exchange of H for D. From the data summarized for the halo and alkyl substituted benzenes it is apparent that deuterium exchange varies significantly for different structural isomers. Thus while o- and p-difluorobenzene exchange all hydrogens rapidly, the meta isomer slowly exchanges only a single hydrogen. Species such as the benzoyl cation, radical cations, and $C_7H_7^+$ derived from toluene and cycloheptatriene do not undergo exchange. It appears that ring protonation is a necessary condition for exchange to occur. (JGB)

Radiation Chemistry

Refer also to abstracts 7886, 7891, and 7901.

6972 (COO-3435-21) ELECTRON PARAMAGNETIC RESONANCE STUDY OF CONFORMATIONAL EFFECTS IN ALKYL-SUBSTITUTED 2-CYCLOHEXANONYL RADICALS IN AN ADAMANTANE MATRIX. Walter, H. F. (Pittsburgh Univ., Pa. (USA)). 1975. 124p. Dep. NTIS $6.50.

Thesis.

Electron paramagnetic resonance spectra have been obtained for radicals produced by x-irradiation of cyclohexanone and various alkyl-substituted cyclohexanones trapped in an adamantane matrix. Temperature variation of these spectra permits determination of the enthalpy and entropy of activation for interconversion between the two half-chair conformations. In those cases where the two conformations have intrinsically different energies, the enthalpy and entropy differences between conformations are determined. For 2-cyclohexanonyl radical, the enthalpy of activation is 3.90 ± 0.07 kcal/mole and the entropy of activation is -2.3 ± 0.3 e.u. Methyl substitution on C_3 or C_5 gives a radical with activation parameters similar to the parent radical, indicating moderate realignment of atoms during the conformational change. Methyl substitution on C_4 gives a radical with lower activation parameters, which are interpreted to indicate conformational change mainly be a folding along the diagonal through the radical site. Larger groups attached to C_3 influence enthalpy and entropy differences between conformations much less than when they are attached to C_5. Very large groups attached to C_5 apparently flatten the ring; it is not known whether or not this is a matrix effect. Deuteration seems to cause a slight reduction in the activation parameters for 2-cyclohexanonyl radical. (auth)

6973 (COO-3435-24) CONFORMATIONAL ANALYSIS OF THE EPR SPECTRA OF CYCLOHEXENYL RADICAL AND SOME OF ITS ALKYL DERIVATIVES. de Tannoux, N. M. (Pittsburgh Univ., Pa. (USA)). 1975. 55p. Dep. NTIS $5.50.

Thesis.

Electron paramagnetic resonance spectra have been obtained for radicals produced by x-irradiation of cyclohexene and various alkyl-substituted cyclohexenes trapped in an adamantane matrix. Temperature variations of these spectra permits determination of the enthalpy and entropy of activation for interconversion between the conformations. For cyclohexenyl radical, the enthalpy of activation is 6.81 ± 0.58 kcal/mole and the entropy of activation is -0.04 ± 2.38 e.u. Methyl substitution on C_1 gives a radical with activation parameters similar to the parent radical. Methyl groups attached to C_5 increase the activation parameters significantly. On the basis of these observations, it is suggested the cyclohexenyl radicals exist in two conformations of the same energy which are of the "envelope" type, with C_1, C_2, C_3, C_4, and C_6 coplanar. A model involving a planar transition state for the interconversion process is proposed which accounts for most of the experimental results. (auth)

6974 (ORO-3781-12) INVESTIGATION OF GAMMA-RAY INDUCED POLYMER FORMATION OF THE CARBORANES. Progress Report, November 1, 1974–October 31, 1975. Klingen, T. J. (Mississippi Univ., University (USA). Dept. of Chemistry). 31 Oct 1975. Contract AT(40-1)-3781. 24p. Dep. NTIS $4.50.

Progress is reported in studies on radioinduced polymerization in organo substituted derivatives of 1,2-dicarba-closo-dodecarborane-(11),o-carborane. They include studies on: INDO calculations of charge transfer; dipole moments and plastic crystallinity; o-carborane radiolysis; and, the radiolysis of 1-phenyl-o-carborane. (JGB)

6975 (FRNC-TH-572) CONDUCTION INDUCED BY RADIATIONS WITH VERY DIFFERENT LINEAR ENERGY TRANSFER IN SOME NONPOLAR ORGANIC LIQUIDS. Casanovas, J. (Toulouse-3 Univ., 31 (France)). 1975. 169p. (In French). Dep. NTIS (US Sales Only) $7.75.

Thesis.

The ionization of some nonpolar dielectric liquids by radiations of very different linear energy transfers was studied. Provided that some experimental precautions are taken the extrapolated free ion yields, G_{fi}^0, (E. Y. method) are in agreement with the clearing field ion yields (C. F. method). The G_{fi}^0 values for ten liquids irradiated by ^{60}Co γ rays and ^{210}Po α particles are given as well as the variation of G_{fi} with temperature ($10°C \leq t \leq 60°C$) and applied electric field ($0 \leq E \leq 30$ kV.cm^{-1}). A similar study was carried out for some binary alkane–alkane and alkane–electronegative compounds (CCl_4, c-$C_8F_{16}O$) mixtures. An hypothesis that would explain the free ion yield "inhibition" in those mixtures is given. By making use of the ONSAGER theory and of high field curves, $G_{fi} = f(E)$, the distribution function, $F(r)$, of separation distances between ions for each liquid was determined. It is concluded that ionization chambers filled with an alkane or an alkane–CCl_4 mixture in good proportions can be used for the dosimetry of x-rays of energy higher than 100 keV and to determine the depth dose curve in a plexiglas phantom irradiated by high energy electrons (10 MeV to 30 MeV) used in radiotherapy. (auth)

6976 RADIOLYSIS OF 3,4-POLYISOPRENE. Kaufmann, R. Munich; Technische Univ. (1974). 61p. (In German). INIS.

Thesis.

The radiolysis of polyisoprene with a high content of 3,4-units was investigated. The synthesis of the polymers was done according to Natta using $Al(C_2H_5)_3/Ti(O\text{-}C_4H_9)_4$ as catalyst. The G-value of the cross-linking was found to be G(cl) = 1.9 from the sol/gel measurements. It is greatly reduced by the addition of the radical catcher anthracene. One may thus conclude that the cross-linking occurs via a radical mechanism and is not based on a chain reaction. Double linkage reduction in 3,4-units were found up to G(−3.4) = 170 by IR spectroscopy. In addition to the cross-linking, a reaction occurs in which the double linkages can be very effectively depolymerized. An attempt was made to obtain further information on the structure of the polymers by means of pyrolysis gas chromatography and identification of the resulting fragments using mass spectrometry. (auth)

6977 REACTION OF CHARGED SPECIES IN IRRADIATED CYCLOHEXANE WITH ADDED SOLUTES AS STUDIED BY STEADY STATE RADIOLYSIS. Relative Rate Constants for Reaction of Positive and Negative Species with Different Solutes. Davids, E. L.; Warman, J. M.; Hummel, A. (Interuniversitair Reactor Inst., Delft, Netherlands). J. Chem. Soc. (London), Faraday Trans., I.; 71: 1252-1264(1975).

The yield of scavenging of electrons in irradiated cyclohexane by CH_3Br and CH_3Cl and of the positive species by cyclopropane in the presence and absence of other solutes that react with one or both of the charged species has been studied. The observed concentration dependences of the scavenging yields are described in terms of an ion-pair picture; the diffusion coefficient of the positive species is much smaller than that of the negative species but much larger than that of a molecular ion. Relative rate constants for the reactions of several solutes with the positive and the negative species are determined from the concentration dependence of the scavenging yields. Using the known value for the absolute rate constant for the reaction of the excess electron with triphenylmethyl chloride, absolute rate constants are calculated. (auth)

6978 ESR STUDY ON THE MECHANISM OF THE RADIOSENSITIZATION BY NITROXIDE FREE RADICALS. Kato, S. (Hokkaido Univ., Sapporo); Kuwabaram, M.; Yoshii, G. Int. J. Radiat. Phys. Chem.; 7: No. 4, 579-581(Aug 1975).

The reaction of an organic nitroxyl free radical (RNO·) with radiation-induced thymine radicals in dilute aqueous solution has been studied at room temperature under O_2, N_2, or N_2O. By using ESR and UV-spectroscopy it has been found that RNO· reacts effectively with OH-induced thymine radicals [T(OH)·] under anoxic conditions, while it did not react with T(OH)· under aerobic conditions. The results lead to the conclusion that RNO· does not contribute to cell death in the presence of oxygen. (auth)

6979 THERMAL DECAY KINETICS OF RADICAL PAIRS IN IRRADIATED SOLIDS. Lembke, R.; Kevan, L. (Wayne State Univ., Detroit). Int. J. Radiat. Phys. Chem.; 7: No. 4, 547-558(Aug 1975).

The thermal decay kinetics of radical pairs in gamma-irradiated polycrystalline di-p-tolyl carbonate and in single crystal N-hydroxyurea have been studied. In both systems careful techniques are worked out to separate the overlapping spectra of the isolated radical and radical pair so that the kinetics of each can be individually studied In the di-p-tolyl carbonate system the radical pairs decay exclusively by reaction together in a first-order process characterized by an activation energy of 35 kJ/mol. In the N-hydroxyurea system the radical pairs decay exclusively apart to form isolated radicals. Quantitative correlation of the radical pair decay with isolated radical growth is demonstrated. The concurrent processes occur with a rate constant of $k = 9.5 \times 10^{-5} s^{-1}$ at 235 K. Although there is a precisely known inhomogeneous spatial distribution in these two systems, it is noted that only first-order decay kinetics are observed. (auth)

6980 Y-TYPE ZEOLITES: THEIR HETEROGENEOUS NATURE AS SHOWN BY ELECTRON SPIN RESONANCE FOLLOWING γ-IRRADIATION. Abou-Kais, A.; Vedrine, J. C.; Massardier, J. (CNRS, Villeurbanne, France). J. Chem. Soc. (London), Faraday Trans., I.; 71: 1697-1706(1975).

The ESR spectra of Y zeolites containing different exchangeable cations have been recorded following γ-irradiation at 77°K. The samples varied in their cation, proton, and Al contents. The spectra were assigned to V center type defects and were separated into two types, the structure and equilibrium of which are proposed. The stability of the V center is strongly dependent on the presence of electron scavengers such as H^+. Discussion of the ESR spectra leads to the conclusion that there is a random distribution of g_3 and to a lesser extent of g_2 components of the g tensor showing that some fluctuations occur in T−O−Si (T = Si or Al) bond angles and T−O bond lengths. This heterogeneity of the material closely corresponds to its heterogeneity in acid strength and catalytic activity. It is postulated and evidence is given that the paramagnetic defects correspond to T−O−Si groups which constitute the zeolitic framework itself, i.e., that the method proposed allows the solid itself to be studied. This conclusion has been applied to the study of aluminium deficient zeolites. It is concluded that silica migrates towards aluminum vacancies during aluminum removal, rebuilding the framework, and that heterogeneity of the material decreases during removal of aluminum. (auth)

6981 ELECTRON PARAMAGNETIC RESONANCE OF X-IRRADIATED TYROSINE, THYRONINE AND THEIR IODINE-DERIVATIVES. Crippa, P. R. (Instituto de Energia Atomica, Sao Paulo, Brazil); Loh, E.; Isotani, S. Radiat. Eff.; 25: No. 1, 13-15 (1975).

The electron paramagnetic resonance of x-irradiated (~10 krad.) tyrosine, thyronine and their iodine-derivatives in the form of compressed pellets in vacuum-sealed quartz tubes have been measured between 100°K and 300°K at ~9 GHz. The EPR spectra of tyrosine, 3-5 diiodo thyronine and thyronine, in the order of decreasing line-width, are spectrally similar singlets with g = 2.004 or 2.005 and hence indicate that the electron spin density is trapped mainly in the ring from which the hydroxyl proton is lost. The samples having iodine on the same ring as the OH group show a rather large anisotropy in $g \approx 2.04$ presumably due to the presence of small spin density on the iodine(s). The G_r value, i.e. the number of paramagnetic centers produced by 100 eV as deduced from the temperature dependence of the magnetic absorption of the irradiated iodine-derivatives increases with the number of iodines on the molecule. The G_r values of tyrosine and thyronine, however, cannot be estimated from the magnetic absorptions, since their absorption increases with the temperature indicating the antiferromagnetic exchange between spin densities on the neighboring molecules. (auth)

6982 FORMATION OF ^{32}P-LABELLED POLYPHOSPHATES IN REACTOR-IRRADIATED SOLUTION OF ORTHOPHOSPHATE: THE ROLE OF OH-RADICALS. Fenger, J.; Pagsberg, P. B. (Danish Atomic Energy Commission, Risoe). J. Inorg. Nucl. Chem.; 37: No. 3, 850-852(Mar 1975).

Reference is made to previously published studies (Fenger et al., J. inorg. nucl. chem.; 35:31 (1973)) of reactor irradiation of solutions of potassium orthophosphate, in which it was found that the sum of the relative yields of ^{32}P-labelled polymers increases with the concentration of the irradiated solution and passes through a maximum at increasing pH. The role of OH-radicals in this reaction is re-examined in the light of later publications (Grabner et al., Int. J. Radiat. Phys. Chem.; 5:393 (1973); and 5:405 (1973)). (UK)

6983 VARIATION OF THE CAPACITY OF CHROMATOGRAPHIC SYSTEMS IN TRANSITIONS TO HIGH ACTIVITIES. II. Comparison of the Effect of Alpha and Gamma Radiolysis of a Cation Exchanger on the Distribution Coefficient, Separation Factor, and Plate Heights. Specht, S.; Dornow, V.; Weinlander, W.; Born, H. J. (Univ., Munich). J. Radioanal. Chem.; 26: No. 1, 17-30(1975). (In German)

The effect of alpha and gamma radiation on the characteristics of the cation exchanger resin AG 50WX8 was studied. (auth)

6984 FAST ELECTRON REACTIONS IN CONCENTRATED SOLUTIONS OF AMINO ACIDS AND NUCLEOTIDES. Aldrich, J. E. (Univ. of Toronto); Lam, K. Y.; Shragge, P. C.; Hunt, J. W. Radiat. Res.; 63: No. 1, 42-52(Jul 1975).

A picosecond pulse radiolysis system was used to study the electron attachment processes encountered in concentrated solutions (0.1 to 3 M). These highly concentrated solutions approximate the conditions of a biological cell. The reaction e⁻/sub aq/ + scavenging molecule has been observed for a range of biologically important molecules. The rate constants depend on the concentration of the solute molecules and the pH of the solution. As well, the initial yield of e⁻/sub aq/ at 30 psec is reduced markedly in concentrated solutions of scavengers such as amino acids and mononucleotides; the initial process is too fast to be explained by normal chemical kinetics. The scavenger which is unique is the hydrogen ion, H^+/sub aq/, which causes no observable reduction of the e⁻/sub aq/ yields, but has a normal rate constant of reaction with e⁻/sub aq/. With other electron scavengers, a general relationship between the efficiency of reducing the initial yield of e⁻/sub aq/ and the rate constant, k/sub e⁻/sub aq/ⱥS/ in concentrated solutions is obtained. This relationship indicates that both the e⁻/sub aq/ and its precursor react with the same efficiency toward the solute molecules. (auth)

6985 INDIRECT EXCITATION OF $Cl^-(^3P)$ IN PULSE-IRRADIATED AQUEOUS SOLUTIONS. Energy Transfer to TlCl/sub n//sup 1-n/ and Electron Transfer to Eu^{3+}. Huang, T.; Hamill, W. H. (Univ. of Notre Dame, IN). J. Phys. Chem.; 79: No. 23, 2465-2469(6 Nov 1975).

In concentrated solutions of NaCl and greater than or equal to 0.05 M $EuCl_3$ a prompt yield of Cl_2^- is attributed to H_2O^+ and a slow yield of Cl_2^- is attributed to electron transfer from Cl^{-*} to Eu^{3+}. The concentration dependence DELTA $G(Cl_2^-)$ vs. $[Cl^-]$ from 0.25 to 1.7 M is consistent with primary energy deposition in water and transfer from a short-lived species to Cl^-. The lifetime of Cl^{-*} is greater than 10^{-8} sec and it is described as $Cl^-(^3P/sub J/)$. The slow yield of Cl_2^- decreases markedly above 2 M NaCl. With approximately 10^{-4} M Tl^+ and concentrated KCl a luminescence under pulsed electron irradiation is the same as that under uv excitation of TlCl/sub n//sup 1-n/. The intensity increases with chloride ion concentration to approximately 2 M, then decreases markedly. The dependence is very similar for concentrated HCl and combination of Cl_2^- with e⁻/sub aq/ cannot be responsible for

excitation. The primary excited species appears to be produced by fast recombination of the dry charge pair, H_2O^+ and e^-. Electron transfer from Cl^- to H_2O^+ at high concentrations of Cl^- suppresses the yield of primary excited species, presumably triplet, and possibly H_2O or H_3O^+. (auth)

6986 ELECTRONIC SPECTRA OF TRAPPED ELECTRONS IN GAMMA-IRRADIATED ORGANIC-MIXTURE GLASSES AT 77K. Ito, T.; Ujikawa, N.; Fueki, K. (Nagoya Univ., Japan). J. Phys. Chem.; 79: No. 23, 2479-2484(6 Nov 1975).

An optical absorption study was made of trapped electrons produced in gamma-irradiated organic-mixture glasses at 77°K. Electronic spectra were observed for trapped electrons in a variety of binary-mixture glasses which consist of solvents with various polarity. Optical parameters obtained from the observed spectra are reported. The spectra of trapped electrons have the only one absorption maximum in all of the mixture glasses studied except for 2-propanol-3-methylpentane glass. The absorption maximum in the spectrum of trapped electrons in a mixed solvent is located at a wavelength between those in pure component solvents, the wavelength depending on the mixture composition. There are two absorption maxima in the spectrum of trapped electrons in 2-propanol-3-methylpentane glass, each maximum corresponding to that in its component spectrum. Changes in the trapped-electron spectra with composition of the mixtures are interpreted in terms of the polarity and structure effects. (auth)

6987 VARIATION IN THE INTENSITY DISTRIBUTION OF THE CH AND CD (A^2DELTA-X^2PI) BAND ROTATIONAL LINES DURING FLUORESCENCE. Schmidt, M.; Gillis, H. A.; Clerc, M. (CEN de Saclay, Gif-sur-Yvette, France). J. Phys. Chem.; 79: No. 23, 2531-2535(6 Nov 1975).

From the intensity variation of the CH and CD (A^2DELTA-X^2PI) (0-0) emission R branch rotation lines, it was possible to determine the initial rotational energy of the radical CH (A^2DELTA) formed by dissociation of acetylene. This energy is equal to 5.5 +- 0.1 kcal mol^{-1} for CH (i.e., 2780°K), and 2.1 +- kcal mol^{-1} for CD (i.e., 1200°K). Addition of helium at low pressure (22 Torr) increased this temperature to 4400°K. A high pressure of He dissipated the rotational energy in less than 500 nsec, in some cases a distribution out of Boltzmann equilibrium was observed. (auth)

6988 RADIOLYSIS OF HYDROCARBONS IN THE PRESENCE OF CARBORANES. I. Influence of o- and m-Carborane on the Formation of Hydrogen from Heptane. Livertovskaya, T. Ya.; Romantsev, M. F.; Kuimova, M. E.; Mikhailov, B. M. (Inst. of Organic Chemistry, Moscow). Bull. Acad. Sci. USSR, Div. Chem. Sci.; 23: No. 12, 2647-2648(Dec 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 12, 2743-2745(Dec 1974).

Radiolysis of n-heptane in the presence of o-carborane, isopropyl-o-carborane, isopropenyl-o-corborane, and m-carborane was investigated. A strong inhibiting effect of the compounds studied on the process of radiolysis was detected. (auth)

6989 ABSOLUTE RATE CONSTANTS OF REACTIONS OF HYDRATED ELECTRON WITH NEPTUNIUM AND PLUTONIUM IONS IN AQUEOUS CARBONATE SOLUTIONS. Pikaev, A. K.; Mefod'eva, M. P.; Krot, N. N.; Spitsyn, V. I. (Inst. of Physical Chemistry, Moscow). Bull. Acad. Sci. USSR, Div. Chem. Sci.; 23: No. 12, 2751-2752(Dec 1974).

Translated from Izv. Akad. Nauk SSSR, Ser. Khim.; 23: No. 12, 2847-2848(Dec 1974).

Pulse radiolysis was used to measure the rate constants of the reaction of the solvated electron ($\bar{e}_{aq}$) with Np(IV), Np(V), Np(VI), and Pu(VI) in aqueous carbonate solutions. It was found that the degree of oxidation of the transuranium element and the carbonate-ion concentration both affect the reactivity toward $\bar{e}_{aq}$. An explanation of these effects is given. (auth)

6990 ELECTRON REACTIONS IN CONCENTRATED AQUEOUS SOLUTIONS OF ACETIC ACID OR GLYCINE. Micic, O. I.; Markovic, V. (Inst. za Nuklearne Nauke Boris Kidric, Belgrade). Int. J. Radiat. Phys. Chem.; 7: No. 4, 541-546 (Aug 1975).

The reactions of hydrated electrons with glycine or acetic acid in aqueous concentrated acid solution have been studied. The reaction mechanism in concentrated solutions is different from that in dilute solutions. The experimental results indicate the existence of very fast reactions, probably occurring before electron hydration. (auth)

6991 RADIATION-INDUCED CHARGE-TRANSFER LUMINESCENCE AND ITS PRIMARY PROCESSES IN TOLUENE. Masuhara, H. (Osaka Univ.); Mataga, N.; Miyazaki, T.; Kuri, Z. Int. J. Radiat. Phys. Chem.; 7: No. 4, 519-527(Aug 1975).

Radioinduced charge-transfer luminescence of several electron donor-acceptor systems was observed for the first time in toluene at room and low temperatures. Observed spectra and fluorescence lifetime are almost the same as those obtained photochemically. The detailed analysis indicates the excitation transfer in the higher excited states of toluene at 77°K. (auth)

6992 LARGE HYDRATED ELECTRON YIELDS IN THE GAMMA RADIOLYSIS OF ACIDIC, OXYGEN-CONTAINING CYSTEINE SOLUTIONS. Al Thannon, A.; El Samahy, A.; Trumbore, C. N. (Delaware Univ., Newark). Int. J. Radiat. Phys. Chem.; 7: No. 4, 559-563(Aug 1975).

The dependence of H_2 yields on cysteine concentration has been studied for aqueous, air-saturated, acidic solutions of cysteine. Up to cysteine concentrations of about 5×10^{-3} mol dm^{-3}, kinetic parameters and yields obtained previously for air-free, acidic solutions of cysteine may be used to predict quantitatively the hydrogen yields observed. However, above these cysteine concentrations experimental yields are larger than predicted. This difference is interpreted in terms of an increase of hydrated electron yields with increasing cysteine concentration via a spur scavenging mechanism. Calculated hydrated electron yields as high as 4.5 are found at cysteine concentrations of about 0.1 mol dm^{-3} and correspond with initial hydrated electron yields observed in pico-second pulse radiolysis studies of aqueous solutions. The concentration dependence of the hydrated electron yields also agrees with that predicted from these pulse radiolysis studies. An unusual effect of oxygen remains unexplained and apparently cannot be attributed to chain reactions occurring in the system. (auth)

6993 SURFACE TENSION OF GLYCIDYLMETHACRYLATE DURING RADIATION POLYMERIZATION. Vishev, Yu. V.; Fainerman, A. E.; Meleshevich, A. P.; Vologina, L. N. (Inst. of Chemistry of High-Molecular Compounds, Kiev). Sint. Fiz.-Khim. Polim.; No. 15, 26-30(1975). (In Russian)

A method based on surface tension measurements showed that radiation polymerization of glycidylmethacrylate takes place chiefly at two bonds. Increase in surface tension at high radiation doses is due to condensation resulting from cross-linking, at a rate of one per monomer link. Calculations of the parachor of the epoxy ring are given. (tr-auth)

6994 X-RAY INDUCED POLYMERIZATION OF PURE ETHYL ACRYLATE. II. Viscosimetric Study of Poly(ethyl acrylate). Saygili, N.; Bas, N. (Centre de la Recherche Nucleaire, Ankara). Tech. J. Ankara Nucl. Res. Cent.; 2: No. 2, 55-59(Jun 1975). (In Turkish).

Samples of poly(ethyl acrylate), obtained during studies on the kinetics of x-ray induced polymerization of pure ethyl acrylate, were studied by viscosimetry in order to determine the dependence of the limit viscosity index on the intensity of the radiation at which the polymers were prepared. It is known that the degree in polymerization number is inversely proportional to the square root of the intensity. From this fact an attempt was made to establish a similar relation between the mean viscosimetric degree of polymerization and the radiation intensity. The validity of this relation was examined. (tr-auth)

6995 CHANGES IN STRUCTURE OF SODIUM CHLORIDE ON MELTING IN AN ELECTRON BEAM. Popel, S. I.; Maslennikov, Yu. I. (Kirov Ural Polytechnic Inst., Sverdlovsk, USSR). Russ. J. Phys. Chem. (Engl. Transl.); 49: No. 1, 3-4(Jan 1975).

Translated from Zh. Fiz. Khim.; 49: No. 1, 4-6(Jan 1975).

Application of an electron beam instead of x-rays has revealed no abrupt change in diffraction pattern when sodium chloride melts: point reflections, which are predominantly composite in structure, coexist with Debye-Scherrer rings over an appreciable temperature range. Analysis of the composite reflections has revealed disturbances of crystal structure preceding melting—accumulation of atoms predominantly of one kind at planar defects, segregation of atoms with a single crystal into hexahedral prisms, etc. (auth)

Radiochemistry and Nuclear Chemistry

6996 RADIOCHEMICAL PURITY OF THE TECHNETIUM-99m—TIN—DIETHYLENE-TRIAMINO-PENTAACETIC ACID COMPLEX. Besnard, M.; Costerousse, O.; Merlin, L.; Cohen, Y. (Centre d'Etudes Nucleaires de Saclay, Gif-sur-Yvette, France). J. Radioanal. Chem.; 26: No. 1, 201-208(1975). (In French)

The radiochemical purity of technetium-99m—tin—diethylene-triamino-pentaacetic acid (DTPA) complex is checked by ascending

paper chromatography. The percentage of uncomplexed technetium is lower than 5%. The technetium valency state is determined by visible absorption spectrometry. (auth)

6997 RADIOAKTIVNYE INDIKATORY V KHIMII. Osnovy Metoda. (Radioactive Tracers in Chemistry. Basic Methods). Luk'yanov, V. B.; Berdonsov, S. S.; Bogatyrev, I. O.; Zaborenko, K. B.; Iofa, B. Z. Moscow; Vysshaya Shkola (1975). 327p.

This book is designed for use in a course on radioactive tracer methods in chemistry and contains theoretical sections including the physical and chemical bases of the technique (radioactivity, recording of radiation, isotope exchange, the behavior of radioactive substances, and methods of separating and concentrating radioactive isotopes) and the principles of the use of radioactive isotopes in analytical, inorganic, physical, and organic chemistry. The methods are illustrated by a large number of problems with appropriate solutions. (tr-auth)

Hot-Atom Chemistry

6998 (COO-2190-16) DYNAMICS AND MECHANISMS OF HOT CHEMISTRY STIMULATED BY RECOIL METHODS. Progress Report, March 1, 1975–February 29, 1976. Spicer, L. D. (Utah Univ., Salt Lake City (USA)). Nov 1975. Contract E(11-1)-2190. 18p. Dep. NTIS $4.50.

A technique for the quantitative investigation of vibrational energy transfer efficiencies at very high levels of excitation is described. In this method chemical activation by nuclear recoil reaction is utilized and the competitive stabilization-decomposition characteristics of the resulting unimolecular system are probed as a function both of pressure and bath gas composition. The relative energy transfer efficiencies for collisions between excited cyclobutane-t and He, Ne, Ar, Kr, Xe, N_2, CF_4, c-C_4H_8 are reported. The hot atom reaction between nuclear recoil chlorine atoms and hydrogen gas to produce translationally excited hydrogen chloride is reported. A sizable hydrogen isotope effect was observed in this system between H_2 and D_2 reactant and there appears to be a cross over from normal to inverse isotope effect as the relative laboratory collision energy is increased above the thermal threshold region. Evidence for electronically excited $S(^1D)$ reactions of nuclear recoil produced sulfur atoms is reported on the basis of relative product yields as a function of electronic energy quenching additives. (auth)

6999 (JUL-940-NC) ELECTROPHILIC AROMATIC SUBSTITUTION IN THE GAS PHASE AS A RESULT OF THE ^{80m}Br-ISOMERIC TRANSITION. Knust, E. J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Nuklearchemie). Mar 1975. 85p. (In German). Dep. NTIS (US Sales Only) $6.00.

It was shown that the nuclear isomeric transition of ^{80m}Br in the presence of high concentrations of Ar moderator is suitable for producing the bromonium ion and studying its ion-molecule reactions. By the use of this method the electrophilic aromatic substitutions of simple substrates, especially monosubstituted benzene, were studied in the gas phase. Reactivity and selectivity effects could be determined by gas radiochromatographic techniques. In contrast to electrophilic aromatic substitutions in solution, the most reactive bromonium ion in the gas phase (ΔH^0 = 300 kcal/Mol) shows only a very weakly marked inter- and intramolecular selectivity. The relative reactivity (benzene = 1) increases slightly from fluorobenzene through chlorobenzene to toluone (1.2, 1.5, 1.9). The isomeric distribution shows only a very weak directing effect on the substituents. In dependence on existing assumptions on ion-molecule reactions it was supposed that the bromonium ion in a rate-determining step first forms an ion-molecule capture complex in which finally a transfer of the electrophil to the various reaction centers occurs with the formation of the o-, m-, and p-arenonium ions. By use of moderator and pressure effects it could be shown in the fluorobenzene system that the strongly exothermic formation of arenonium ions leads to an excitation isomerization which is extensively controlled kinetically. The proton transfer occurs through a substrate molecule before or after the rearrangement according to the pressure and concentration ratios. In addition to the substitution of hydrogen there is also the introduction of functional groups as CH_3, F, Cl, and Br. The yield in ^{80}Br-labelled bromobenzene increases with decreasing C-functional group bond energy. By use of the p-difluorobenzene system it could be shown that the substitution of the F was also accompanied by rearrangement. (tr-auth)

Properties of Radioactive Materials

Refer also to abstracts 6959, 6960, 7629–7631, 7887, 8508, and 8560.

7000 (ANCR-1257) REMOVAL OF THE MATERIALS TEST REACTOR OVERHEAD WORKING RESERVOIR. Lunis, B. C. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Oct 1975. Contract E(10-1)-1375. 24p. Dep. NTIS $4.00.

Salient features of the removal of an excessed contaminated facility, the Materials Test Reactor (MTR) overhead working reservoir (OWR) from the Test Reactor Area to the Radioactive Waste Management Complex at the Idaho National Engineering Laboratory are described. The 125-ton OWR was an overhead 160,000-gallon-capacity tank approximately 193 feet high which supplied cooling water to the MTR. Radiation at ground level beneath the tank was 5 mR/hr and approximately 600 mR/hr at the exterior surface of the tank. Sources ranging from 3 R/hr to in excess of 500 R/hr exist within the tank. The tank interior is contaminated with uranium, plutonium, and miscellaneous fission products. The OWR was lowered to ground level with the use of explosive cutters. Dismantling, decontamination, and disposal were performed by Aerojet Nuclear Company maintenance forces. (auth)

7001 (ANL-75-47) CHEMICAL ENGINEERING DIVISION THERMOCHEMICAL STUDIES. Annual Report, July 1974–June 1975. O'Hare, P. A. G.; Johnson, G. K.; Ader, M.; Hubbard, W. N.; Fredrickson, D. R.; Cafasso, F. A.; Burris, L. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 56p. Dep. NTIS $5.45.

Standard enthalpies of formation were determined for the following compounds: $Cs_2U_2O_7$(c), beta-Na_2UO_4(c), $BaUO_4$(c), HI(aq), $CsNO_3$(c), Cs_2CO_3(c), CsCl(c), RbCl(c), Cs_2CrO_4(c), and $Cs_2Cr_2O_7$(c). Preliminary reaction calorimetric studies of WS_2 and Li–Al alloys are described. High-temperature enthalpies and other thermodynamic properties are reported for alpha- and beta-Na_2UO_4(c), Cs_2UO_4(c), and Al_2O_3(c). (auth)

7002 (ANL-75-50) CHEMICAL ENGINEERING DIVISION, LIQUID METALS CHEMISTRY AND TRITIUM CONTROL TECHNOLOGY ANNUAL REPORT, JULY 1974–JUNE 1975. Maroni, V. A.; McPheeters, C. C.; Calaway, W. F. (Argonne National Lab., Ill. (USA)). Sep 1975. Contract W-31-109-Eng-38. 44p. Dep. NTIS $4.00.

A program is in progress to develop the capabilities for monitoring hydrogen and tritium in LMFBR sodium and cover gas and to develop means of control of tritium in sodium. Both the in-sodium and cover-gas tritium monitors are similar in design to the hydrogen monitors. The in-sodium tritium monitors were tested for response to changes in tritium level in sodium. A cover-gas tritium monitor was designed for testing and further development. Final results of tensimetric studies of the Li–LiD system are reported. Comparison of the Li–LiD data with previous results for the Li–LiH system shows that the isotope effects in these systems originate largely from the gas phase. The solubility of hydrogen in beta-phase Li–Al alloy was found to be significantly lower than that in pure lithium at comparable temperatures and equilibrium hydrogen pressures. Decomposition pressure data, together with previously measured solubilities of Li_3N in liquid lithium, were used to determine (1) the equilibrium constant for the formation of Li_3N/sub (s)/ from liquid lithium and gaseous nitrogen, (2) the free energy of formation of solid Li_3N, and (3) the Sieverts' law constant for dilute solutions of Li_3N in liquid lithium. Hydrogen permeation characteristics of multiplex metal laminates indicate that these materials may be of potential utility as barriers to tritium migration. Studies of the kinetics of chemical trapping reactions involving tritium in inert gas streams are reported. Progress in the assessment of tritium handling and containment requirements for a tokamak experimental fusion power reactor (TEPR) is reported. (JGB)

7003 (UNI-SA-18) DECONTAMINATION AND DECONTAMINANT WASTE DISPOSAL. Kratzer, W. K. (United Nuclear Industries, Inc., Richland, Wash. (USA)). 9 Oct 1975. 20p. Dep. NTIS $4.50.

Typical decontaminations expected at nuclear power reactors and the problems associated with the processing of decontamination wastes are described. (LK)

7004 CHEMISTRY OF THE TRIVALENT ACTINOIDS. IV. Nephelauxetic Effects as a Guide to Complex Formation for Uranium (III) and Neptunium (III). Bullock, J. I.; King, M. E. (Surrey Univ., Guildford, Eng.). J. Chem. Soc. (London), Dalton Trans.; No. 13, 1360-1364(1975).

In the absence of oxygen, neptunium (III) is much more stable towards oxidation than uranium (III) in aqueous solutions of complexing agents. Nephelauxetic shifts have been found for both metal ions and used as a guide to complex formation for the tri- and quadri-valent states; those for neptunium are less than those for uranium in each oxidation state. An improved method for the production of Np^{III} is described. (auth)

7005 STUDY OF LOWER VALENCE STATES OF TECHNETIUM. Bratu, C.; Bratu, G.; Galateanu, I.; Roman, M. (Inst. of Atomic Physics, Bucharest). J. Radioanal. Chem.; 26: No. 1, 5-16(1975).

The lower valence states of technetium under the conditions of the preparation of radiopharmaceuticals were studied by polarography and cerimetry. The results indicate that the reduction of Tc(VII) by ascorbic acid in the absence of HCl takes place only to Tc(V), but in the presence of 20% HCl to Tc(IV). The reduction of Tc(VII) by stannous chloride proceeds only to Tc(V) and was confirmed by cerimetry. The polarographic reduction of Tc(VII) in the non-aqueous electrolyte acetonitrile, thus firstly studied, indicated a great tendency of technetium reduced species to hydrolyse. The formation of hydrolyzed species like $TcO(OH)^+$, $TcO(OH)_2$ for Tc(IV) and $TcO(OH)_2^+$ for Tc(V) is supposed which influence the technetium binding capacity during its incorporation into radiopharmaceuticals. (auth)

7006 INTERACTION OF URANYL (VI) AND d-TRANSITION METAL IONS WITH A CYCLIC SCHIFF BASE. Vigato, P. A.; Vidali, M.; Casellato, U.; Graziani, R.; Benetollo, F. (Padua Univ.). Inorg. Nucl. Chem. Lett.; 11: No. 9, 595-599(Sep 1975).

A uranyl (VI) complex was prepared with the macrocyclic sexadentate ligand derived from the condensation of ethylenediamine and heptane-2,4,6-trione. The uranyl (VI) adduct was obtained also when uranyl (VI) salts, ethylene diamine and heptane-2,4,6-trione were brought together simultaneously. The properties of the complex are discussed. Infrared spectra, magnetic susceptibility data and x-ray diffraction data are given, and a structure for the complex is proposed. (UK)

7007 INDENYL COMPOUNDS OF ACTINIDE ELEMENTS. I. Triindenylthorium Bromide and Triindenyluranium Bromide. Goffart, J.; Fuger, J.; Gilbert, B.; Hocks, L.; Duychaerts, G. (Liege Univ.). Inorg. Nucl. Chem. Lett.; 11: No. 9, 569-583 (Sep 1975).

The synthesis of new organometallic compounds of actinides, $(C_9H_7)_3ThBr$ and $(C_9H_7)_3UBr$, is reported. Some properties of the triindenylactinide bromide compounds are described and compared with those of triindenylactinide chloride compounds. Mass, infrared, Raman, and electronic spectra and partial x-ray powder diagrams are given. $(C_9H_7)_3UBr$, $(C_9H_7)_3ThBr$ and $(C_9H_7)_3ThCl$ are not isomorphous. Evidence is given for the presence of metal-to-indenyl ligands π bonds. (auth)

7008 COMPLEX OF A CYCLIC POLYETHER 18-CROWN-6 WITH URANYL NITRATE. Costes, R. M.; Folcher, G.; Keller, N.; Plurien, P.; Rigny, P. (CEN, Gif-sur-Yvette, France). Inorg. Nucl. Chem. Lett.; 11: No. 7/8, 469-473(Jul 1975).

A report is presented on the first results on the synthesis and characterization of a uranyl 18-crown-6 complex: whose stoichiometry is UO_2, crown, $(NO_3)_2.(H_2O)_4$. This compound is interesting on account of the ability of the uranyl ion to localize coordination in the equatorial plane. Results of spectroscopic studies are also presented and analyzed under the hypothesis that the uranyl ion is located in the center of the cyclic ligand. (auth)

7009 METHODS FOR RADIOCHEMICAL AND RADIONUCLIDIC PURITY DETERMINATION OF SOME ^{99m}Tc AND ^{113m}In RADIOPHARMACEUTICALS. Galateanu, I.; Roman, M.; Zamfir, I.; Lungu, V.; Uncuta, C.; Fodor, G. (Inst. of Atomic Physics Department of Radioisotopes and Labelled Compounds, Bucharest). J. Radioanal. Chem.; 26: No. 1, 189-199(1975).

In order to determine the radiochemical impurities in pertechnetate solution as well as that of unbound ^{99m}Tc in its colloid and complex compounds, in indium chloride solution and related compounds, paper chromatography on Whatman No. 1, thin-layer chromatography on silica gel plates, and paper electrophoresis were applied. A simple method for the determination of radionuclidic purity was developed. (auth)

7010 MOESSBAUER STUDY OF POST-EFFECTS IN SUBSTITUTED COBALT β-DIKETONATES CAUSED BY ^{57}Co DECAY. Afanasov, M. I.; Perfiliev, Yu. D.; Babeshkin, A. M. (Moscow State Univ.). J. Radioanal. Chem.; 27: No. 1, 125-128(1975).

^{57}Co Mössbauer emission spectra of cobalt benzoylacetonate and 3-substituted acetylacetonates have been studied. All spectra reveal the same stabilized ^{57}Fe forms, though in a ratio depending on the substituent in the ligand. This dependence is interpreted in terms of the substituent effect on the nature of metal-ligand bonding. (auth)

7011 SYNTHESIS OF D,L-LANTHIONINE-^{35}S AND D,L-LANTHIONINE SELENIDE-^{75}Se. Hanus, J.; Benes, J.; Kozel, J. (Inst. for Biological Research, Prague). Radiochem. Radioanal. Lett.; 23: No. 1, 33-35(15 Oct 1975).

Addition of D,L-cysteine-^{35}S to 2-acetamidoacrylic acid resulted in D,L-lanthionine-^{35}S in 73% yield $Al_2{}^{75}Se_3$ reacted with diethyl 2-acetamido-2-dimethylamino malonate iodomethylate and after hydrolysis and purification on a cellulose column D,L-lanthionine selenide-^{75}Se was prepared with 31% yield. (auth)

7012 VIEWS ON QUALITY TESTS OF RADIOPHARMACEUTICALS. Cohen, Y. (CEN de Saclay, Gif-sur-Yvette, France). J. Radioanal. Chem.; 26: No. 2, 317-325(1975).

The quality tests of radionuclides produced from generators (^{99}Mo → ^{99m}Tc, ^{113}Sn → ^{113m}In) have been reviewed. The quality controls of radiopharmaceuticals derived from these radionuclides and prepared with the help of ready-for-use reagents assembled in kits have been presented. The possibility of new tests regarding sterility (by means of a radiometric method) and detection of endotoxin (based on gelification of limulus amoebocyte lysate) have been suggested. (auth)

7013 LABELLING TRANSFERRIN WITH ^{131}I AND ^{59}Fe. de Castiglia, S. G. (Comision Nacional de Energia Atomica, Buenos Aires); de Sudrez, A. H. F.; Mitto, A. E. A. Rev. Soc. Cient. Parag.; 13: No. 1, 39-42(1972). (In Spanish)

Transferrin labelled with ^{131}I and ^{59}Fe for use in the total body counter was prepared. A good yield of the reaction was obtained. The integrity of the labelled molecule was checked before its use. (auth)

7014 MIXED LIGAND DERIVATIVES OF Th(IV)–EDTA OR CDTA CHELATE WITH ETHYLENEDIAMINE AND 1,2-PROPANEDIAMINE. Pachauri, O. P.; Tandon, J. P. (Univ. of Rajasthan, Jaipur, India). Acta Chim. Acad. Sci. Hung.; 86: No. 1, 39-46 (1975).

The formation of mixed ligand derivatives of Th(IV) with N, N, N', N'-ethylenediaminetetraacetic acid (EDTA) or cyclohexane-trans-1,2-diaminetetraacetic acid (CDTA) as primary ligand and certain diamines such as ethylenediamine (en) or 1,2-propanediamine (1,2-pn) as secondary ligand has been shown by potentiometric studies. 1:1:1 ternary complexes are formed. The formation constants ($\log K_{MAB}$) of the mixed ligand complexes have been calculated at 30 ± 1°C and μ = 0.1 (KNO_3) at different pH values. The order of stability in terms of primary ligand has been found to be EDTA > CDTA and in terms of secondary ligand as 1,2-pn > en. (auth)

Radioactive Waste Treatment

Refer also to abstract 7003.

7015 (DEU-75-20) RADIOACTIVE WASTE: PRODUCTION AND DISPOSAL. (Werner und Pfleiderer Maschinenfabrik, Stuttgart (F. R. Germany)). 1975. 29p. (In German). INIS.

17 figs.; 2 tabs.; 16 refs.

The company report deals with the whole cycle of radioactive waste, from its production in various nuclear facilities to its disposal or final storage following a special treatment to substantially reduce the volume of the waste and to achieve an end product of high stability and resistance against many outside influences. The continuous, automatic solidification process (using bitumen as a matrix for the active waste), which is the most modern form of technology used in the FRG for the solidification of medium-level wastes, is described in detail. In this process, a multiple-shaft screw-type extruder whose self-cleaning screw-type profiles guarantee a good mixing effect, provides a disperse bitumen-salt mixture, while at the same time the water is reduced to less than 10% by heating, and the final product is automatically filled in containers. (GE)

7016 (DPST-75-452) THEORETICAL ASPECTS OF SOLID WASTE INCINERATION. Tarbell, J. M. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 24p. Dep. NTIS $4.50.

Theoretical considerations that may be incorporated into the design basis of a prototype incinerator for solid transuranic wastes are described. It is concluded that primary pyrolysis followed by secondary afterburning is a very unattractive incineration strategy unless waste resource recovery is a process goal. The absence of primary combustion air leads to poor waste dispersion with associated diffusion and conduction limitations rendering the process inefficient. Single step oxidative incineration is most attractive when volume reduction is of primary importance. The volume of this type of incinerator (including afterburner) should be relatively much smaller than the pyrolysis type. Afterburning is limited by soot oxidation when preceded by pyrolysis, but limited by turbulent mixing when preceded by direct solid waste oxidation. In either case, afterburner temperatures

above 1300°K are not warranted. Results based on a nominal solid waste composition and anticipated throughput indicate that NO /sub x/, HF, and SO_2 will not exceed the ambient air quality standards. Control of radioactive particulates, which can be achieved by multiple HEPA filtration, will reduce the conventional particulate emission to the vanishing point. Chemical equilibrium calculations also indicate that chlorine and to a lesser extent fluorine may be precipitated out in the ash as sodium salts if a sufficient flux of sodium is introduced into the incinerator. (auth)

7017 (MLM-2270) TRITIUM EFFLUENT CONTROL PROJECT. Progress Report, April--June 1975. Kershner, C. J.; Bixel, J. C. (Mound Lab., Miamisburg, Ohio (USA)). 17 Nov 1975. Contract E-33-1-GEN-53. 13p. Dep. NTIS $4.00.

In the tritiated liquid waste decontamination program, the major effort was directed toward procurement of the equipment needed to perform feasibility experiments on water detritiation. The catalytic water detritiation system was fabricated and helium leak tested by Engelhard Minerals and Chemicals Corporation. The system was received at Mound and will be installed in the Tritium Effluent Control Development Laboratory. (LK)

7018 (Y-1990) DENITRIFICATION OF ACID WASTES FROM URANIUM PURIFICATION PROCESSES. Clark, F. E.; Francis, C. W.; Francke, H. C.; Strohecker, J. W. (Oak Ridge Y-12 Plant, Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. Dep. NTIS $5.45.

Laboratory and pilot-plant investigations have shown the technical feasibility of removing nitrates from neutralized acid wastes from uranium purification processes by biological denitrification, a dissimilatory process in which the nitrate ion is reduced to nitrogen gas by specific bacteria. The process requires anaerobic conditions and an organic carbon source, as well as other life-sustaining constituents. These denitrification studies produced process design information on a columnar denitrification plant and on continuous-flow, stirred-bed reactors. Denitrification, using packed columns, was found to be desirable for soluble salts, such as those of sodium and ammonium; denitrification, using stirred reactors, was found to be desirable for mixtures containing insoluble salts, such as those of calcium and aluminum. Packed columns were found to have denitrification rates ranging up to 122 grams of nitrate per day per cubic decimeter of column volume; stirred-bed reactors have been shown to have reaction rates near 10 grams of nitrate per day per cubic decimeter of reactor volume. The continuous-flow, stirred-bed reactors were selected for scaleup studies because of the solids-removal problems associated with packed columns when operating on feeds containing high concentrations of insoluble salts or ions which form insoluble salts with the products of the denitrification reaction. (auth)

7019 SORBENTS FOR THE PURIFICATION OF LOW- AND MEDIUM-LEVEL RADIOACTIVE WATERS. Review of Developments, 1969–1974. Berak, I.; Uher, E.; Marhol, M. (Nuclear Research Inst., Rez, Czech.). At. Energy Rev.; 12: No. 2, 325-366(Jun 1975).

Selected articles in the literature published between 1969 and 1974 on the use of sorbents in the purification of low- and medium-level radioactive waters are surveyed. Selected work in the synthesis and laboratory testing of new sorbents that can be considered promising is considered. As used in the review, the term sorbents refers to substances in which there is pronounced accumulation of microconstituents from solutions and which are not components of living organisms. The review ties up with two specialized manuals published by the IAEA in Vienna, "Operation and Control of Ion-Exchange Processes for Treatment of Radioactive Wastes," Technical Reports Series No. 78 (1967), and "Use of Local Minerals in the Treatment of Radioactive Waste," Technical Reports Series No. 136 (1972). (auth)

7020 SORPTION OF COBALT ON MODIFIED CLINOPTILOLITES. Gradev, G. D.; Daiev, G. T.; Pekov, G. I. (Inst. for Nuclear Research and Nuclear Energy, Sofia). J. Radioanal. Chem.; 26: No. 2, 261-269(1975).

The sorption of cobalt on natural and modified clinoptilolites has been studied. It has been demonstrated that the higher sorption of cobalt on modified clinoptilolites than on natural ones is due to precipitation reactions. The precipitates formed on the scrbent have been investigated by infrared spectrometrical, microscopical, and x-ray analyses. The capacity values of the corresponding metal forms of clinoptilolite have been obtained with cobalt. Deactivation of radioactive solutions containing ^{134}Cs, ^{137}Cs, ^{204}Tl and ^{60}Co ions simultaneously on natural sorbents by orecipitation reaction has been achieved. (auth)

Radioisotope Production

Refer also to abstract 7404.

7021 (BNL-20326) PRODUCTION AND QUALITY CONTROL OF IODINE-123. Lambrecht, R. M.; Kondo, K.; Wolf, A. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 30p. (CONF-750564-2). Dep. NTIS $4.50.

From iodine-123 planning conference; Rockville, Maryland, USA (19 May 1975).

The various methods for production and quality control are discussed. The author feels the ^{123}Xe-^{123}I generator is the best method of production. Preparation and use of ^{123}I-labeled compounds are also considered. (LK)

7022 STUDY ON THE SEPARATION AND DISTRIBUTION OF THE CHEMICAL FORMS OF ^{131}I PRODUCED FROM THERMAL NEUTRON-IRRADIATED TELLURIUM COMPOUNDS BY THIN-LAYER CHROMATOGRAPHY. Maki, Y. (Industrial Research Inst., Yokohama-shi, Japan). J. Radioanal. Chem.; 27: No. 1, 33-45(1975).

The separation and distribution of the chemical forms of ^{131}I produced from thermal neutron-irradiated tellurium compounds were investigated by thin-layer chromatography using alumina as adsorbent and water as developer as well as the effect of iodine carriers added on the distribution of different chemical forms of ^{131}I was studied. The effects of both atmospheric oxygen and light were investigated on the oxidation of carrier-free iodide on the thin-layer plate. (auth)

7023 4-(5-NONYL)PYRIDINE EXTRACTION OF PLATINUM FROM DIFFERENT AQUEOUS SOLUTIONS. Reactor Production of Carrier-Free ^{199}Au. Iqbal, M.; Ejaz, M. (Pakistan Inst. of Nuclear Science and Tech., Rawalpindi). J. Radioanal. Chem.; 27: No. 1, 15-24(1975).

The partition of tracer-level ($<10^{-7}$ mole/l) platinum between various 4-(5-nonyl)-pyridine phases and aqueous nitric, hydrochloric, and sulfuric acid phases has been studied radiometrically as a function of the amine and acid concentrations. The effects of salting out agents and some anions on the extraction of the metal are reported. The extraction data is compared with that of gold and conditions are established for the separation of daughter ^{199}Au from neutron irradiated platinum. The distribution coefficients of various metal ions are given for the 4-(5-nonyl)pyridine–10M HCl system and their factors for separation from platinum estimated. (auth)

7024 PRESENT AND FUTURE OF RADIOPHARMACEUTICALS RESULTING FROM GENERATORS. Mitta, A. E. A. (Comision Nacional de Energia Atomica, Buenos Aires). J. Radioanal. Chem.; 27: No. 1, 129-136(1975).

The production method, the advantages and disadvantages of some radiopharmaceuticals produced in different generators are shown. Considerations are given with respect to the frequently used generators. (auth)

Reactor Fuel Reprocessing

Refer also to abstracts 7265, 8712, and 8757.

7025 (ARH-1514) CRITICALITY PREVENTION SPECIFICATIONS THORIUM–URANIUM-233 SEPARATIONS IN THE PUREX PLANT. Matheison, W. E.; Oberg, G. C.; Ritter, G. L. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 1 Jun 1970. Contract AT(45-1)-2130. 51p. Dep. NTIS $5.50.

The specifications in this document define the limits or restrictions required to maintain an acceptably low probability of the occurrence of a nuclear chain reaction in the Purex Plant while processing irradiated thoria targets. These criticality prevention specifications do not stipulate the system, procedures, or mechanisms to permit operation within the limits or restrictions. (LK)

7026 (ARH-1748) PUREX PLANT CHEMICAL FLOWSHEET FOR THE 1970 THORIUM CAMPAIGN. Smith, G. F. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 10 Jul 1970. Contract AT(45-1)-2130. 56p. Dep. NTIS $5.50.

The chemical flowsheets recommended for the 1970 thorium campaign are presented and are basically the same as those used for the 1966 campaign. (LK)

7027 (ARH-1757) PROCESS SPECIFICATIONS AND STANDARDS FOR THE 1970 THORIUM CAMPAIGN IN THE PUREX PLANT. Van der Cook, R. E.; Ritter, G. L. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 30 Jun 1970. Contract AT(45-1)-2130. 31p. Dep. NTIS $5.00.

The process specifications and standards for thorium processing operations in the Purex Plant are presented. These specifications represent currently known limits within which plant processing conditions must be maintained to meet defined product requirements safely and with minimum effect on equipment service life. These specifications cover the general areas of feed, essential materials, and chemical hazards. (LK)

7028 (ARH-1774) QUALITY CONTROL PROGRAM, PUREX THORIA PROCESSING. Nicholson, G. A. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 10 Aug 1970. Contract AT(45-1)-2130. 27p. Dep. NTIS $5.00.

The quality control activities associated with the production of ^{233}U by separation from irradiated thoria and other radioactive contaminants are described. (LK)

7029 (ARH-1775) PROCESS CONTROL GUIDELINES FOR CY 70 THORIUM CAMPAIGN. Jackson, R. R. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 29 Jul 1970. Contract AT(45-1)-2130. 63p. Dep. NTIS $5.50.

The report comprises five parts, with Part I being an introduction. Part II consists of a general treatment of process control methods. Parts III through V discuss, in the flowsheet sequence, those problems pertinent to each equipment piece or system and provide operating guidelines. Specific operations that are somewhat different from those normally encountered in Purex are discussed at length. Operations routine to Purex can be found in the pertinent standard operating procedures. Part VI describes in general terms the sequence to be followed in initiating and completing a variety of transient conditions. (LK)

7030 (DOCKET-50332-53) BARNWELL NUCLEAR FUEL PLANT. IE Inspection Report No. 75-13. (Allied-Gulf Nuclear Services, Barnwell, S. C. (USA)). 31 Oct 1975. 8p.

Copies of the following documents are presented: letter to N. C. Moseley from Allied-General Nuclear Services dated October 16, 1975; letter to Allied-General Nuclear Services from N. C. Moseley dated October 7, 1975; and Region II Inspection Report No. 50-332/75-13. (LK)

7031 (DOCKET-50332-54) BARNWELL NUCLEAR FUEL PLANT. IE Inspection Report No. 75-7. (Allied-Gulf Nuclear Services, Barnwell, S. C. (USA)). 12 Aug 1975. 10p.

This docket comprises copies of the letter to N. C. Moseley from Allied-General Nuclear Services dated August 6, 1975, the letter to Allied-General Nuclear Services from N. C. Moseley dated July 18, 1975, and Region II inspection report No. 50-332/75-7. (LK)

7032 (ISO-419) THORIUM PROCESS OPERATION REPORT. (Isochem Inc., Richland, Wash. (USA)). Dec 1967. Contract AT(45-1)-1851. 142p. Dep. NTIS $7.00.

Declassified 3 Aug 1973.

Preparation for the Purex thorium campaign began on April 15, 1966 when the plant was cleaned out and stripped from uranium processing. Flushing and equipment changes involved in the turnaround for thorium processing were completed on May 11, 1966, when irradiated thoria was first introduced to the plant dissolvers. The last of the thoria was charged to the dissolvers on July 2, 1966, and product stripping operations were completed on July 10, 1966. Plant flushing and equipment changes associated with reconversion of the plant to uranium processing were completed by August 20, 1966. One hundred ninety-four tons of thoria was processed during the campaign; the product, thorium nitrate solution, was transferred to the WR Vault for temporary storage. Two hundred twenty-three kilograms of ^{233}U were recovered during the campaign. One hundred twenty kilograms have been delivered to the Nuclear Fuels Services facility in Erwin, Tennessee; the remainder has been shipped to Oak Ridge. At the start of the campaign, 3.4 tons of thorium nitrate product from the thorium test run were reworked to meet specifications. Tight specifications for both thorium and ^{233}U products were met during the campaign. The quality of the ^{233}U product exceeded target specifications in almost every area. Recovery of thorium and ^{233}U were 97 percent and 94 percent, respectively. The overall material balance on the two products was within 1.2 percent and 2.3 percent, respectively. (auth)

7033 (JUL-1212) METHODS FOR THE SEPARATION OF PLUTONIUM FROM THE WASTE STREAM OF A REPROCESSING INSTALLATION FOR HTR FUEL ELEMENTS. Herz, D.; Kankura, R.; Wenzel, U. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Chemische Technologie). Jul 1975. 36p. (In German). Dep. NTIS (US Sales Only) $5.00.

Purification of the process-streams from Pu in a spent Th-U-fuel reprocessing plant can be accomplished by column extraction chromatography using a breakthrough technique. The stationary phase consists of polytrifluoromonochloroethylene coated with trioctylamine, the mobile phase of 2 M HNO_3. After feed adjustment of the corresponding process-stream to extraction conditions Pu is extracted into the stationary phase of the separation column. Because of the Th-Pu-exchange delay in TOA the HETP is strongly dependent on the linear flow velocity. Layout data are given for a separation unit with a throughput of 2 kg of heavy metal per day in accordance to the throughput of the JUPITER-pilot plant in Jülich. (auth)

7034 (ORNL-TM--5123) MODIFICATIONS OF THE SEPHIS COMPUTER CODE FOR CALCULATING THE PUREX SOLVENT EXTRACTION SYSTEM. Watson, S. B.; Rainey, R. H. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 59p. Dep. NTIS $5.45.

The SEPHIS computer program was developed to simulate the countercurrent solvent extraction. This report gives modifications in the program which result in improved fit to experimental data, a decrease in computer storage requirements, and a decrease in execution time. Methods for applying the computer program to practical solvent extraction problems are explained. (auth)

7035 IMPROVEMENTS IN OR RELATING TO THE FORMATION OF LIQUID DROPLETS. Wace, P. F. (to United Kingdom Atomic Energy Authority). British Patent 1,395,486/B/. 29 May 1975. Filed Date 21 Apr 1972. 4p.

In certain processes, such as the production of spheres by sol/gel processes, and in spray drying operations, there is a requirement for the rapid production of liquid droplets, suitable for subsequent treatment to produce the desired product. The principle of rapid droplet formation involves ejection of a liquid through an orifice as a jet which is simultaneously vibrated, but methods based on this principle tend to have the disadvantage that for small droplets and small orifices the overall yield in a given period of time is low. The apparatus described enables a much larger yield to be obtained. The apparatus has a lightweight dropping head in the form of a spinerette with a number of orifices of uniform and accurate size and position to provide a number of liquid jets. Means are provided for vibrating the head to cause breakup of the jets. The droplets are passed into a column containing a reagent capable of causing gelling. The spinerette is vibrated by a mechanically coupled electromagnetic vibrator. The droplets may be partially gelled by contacting with a gaseous reagent, followed by contacting with a liquid reagent to complete gelation. The gaseous reagent may be NH_3 and the liquid reagent may be NH_4OH. The droplets may contain nuclear fuel material. (UK)

CONTROLLED THERMONUCLEAR RESEARCH

Refer also to abstract 8797.

Plasma Confinement and Heating

Refer also to abstracts 7050, 7118, 7145, and 7154.

7036 (CONF-751125-65) SOME PHYSICS CONSIDERATIONS FOR TEPR DESIGNS. Hogan, J. T.; Rome, J. A.; McAlees, D. G.; Attenberger, S. E. (Oak Ridge National Lab., Tenn. (USA)). 1975. 5p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A simplified version of the Oak Ridge Tokamak Transport Code is used to assess the implications of confinement scaling, impurity trapping of neutral beam particles and plasma currents driven by neutral injection. The ORNL, ANL and GAC experimental power reactor reference designs are considered. (auth)

7037 (ERDA-tr-68) ENERGY BALANCE IN LARGE INSTALLATIONS OF "TOKAMAK" TYPE. Dnestrovskii, Yu. N.; Kostomarov, D. P.; Lysenko, S. E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1975. Translation of IAE-2494. 43p. Dep. NTIS $4.00.

On the basis of one-dimensional equations of the energy balance, an analysis is made of the heating of plasma in large installations of the Tokamak type of the eightieth generation. Typical dimensions of the examined installations are: R equals 400 cm, a equals 150 cm. "Pseudoclassical" and "Bomov" models of thermal conductivity are used in the computations. Heating of plasma is taken into account with the aid of injection of a beam of fast neutral particles, cooled by an influx of cold neutral particles from vacuum, transfer of energy of alpha-particles to the plasma, and cyclotron radiation and bremsstrahlung. (auth)

7038 (IPP-1/154) INVESTIGATION OF THE PREIONIZATION IN THE HIGH VOLTAGE BELT PINCH. Protz, R. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jul 1975. 40p. (In German). Dep. NTIS (US Sales Only) $5.00.

Shock compression experiments require a highly ionized, homogeneous and magnetic field free initial plasma. The production and investigation of such low density plasmas ($n_0 = 10^{13}$ to 10^{14} cm^{-3}) in a belt-pinch configuration is reported. The two-stage preionization is done by an initial rf-pulse (ν = 80 Mc) and a following slow belt-pinch discharge (ν = 24 kc, W = 17 kJ). 90° multichannel laser-light scattering is used for measuring the radial electron density profile spatially resolved by one shot. This diagnostics has been developed and tested for measurements of the shock compression. After the second half-cycle of the oscillating discharge one gets a highly ionized (ionization degree $\alpha \approx 60\%$) sufficiently homogeneous plasma down to a filling pressure of 0.5 mTorr Deuterium. Probe measurements show negligible magnetic fields in the plasma at this time. So all requirements are fullfilled for shock wave experiments in low density plasmas. (auth)

7039 (IPP-6/133) NEW MACROSCOPIC THEORY OF ANOMALOUS DIFFUSION INDUCED BY THE DISSIPATIVE TRAPPED-ION INSTABILITY. Wimmel, H. K. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1975. 36p. INIS.

1 tab.; 6 refs.

For an axisymmetric toroidal plasma of the TOKAMAK type a new set of dissipative trapped-fluid equations is established. In addition to E vector x B vector drifts and collisions of the trapped particles, these equations take full account of the effect of $E_{||}$ (of the trapped ion modes) on free and trapped particles, and of the effect of grad δ_0 (δ_0 = equilibrium fraction of trapped particles). From the new equations the linear-mode properties of the dissipative trapped-ion instability and the anomalous diffusion flux of the trapped particles are derived. (auth)

7040 (TID-26910) NEUTRAL-BEAM CONTROL STUDY, PHASE 1. Final Report. (Draper (Charles Stark) Lab., Inc., Cambridge, Mass. (USA)). Nov 1975. Contract AT(11-1)-2572. 49p. Dep. NTIS $5.00.

This report describes investigations into the technical and operational elements of the control of multiple neutral-beam injectors in experimental systems. In particular, a heuristic model of the source behavior during conditioning operations is developed and used as a basis for control-loop development. The control-loop components, various estimators, and control laws are developed, and a formal control strategy utilizing these components is defined. (auth)

7041 (UCRL-77079) EXPERIMENTAL DETERMINATION OF DT ION TEMPERATURES IN LASER FUSION TARGETS. Ahlstrom, H. G.; Slivinsky, V. W.; Tirsell, K. G.; Storm, E. K.; Glaros, S. S.; Campbell, D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Oct 1975. 18p. (CONF-751130-1). Dep. NTIS $4.00.

From ASP meeting; St. Petersburg, Florida, USA (10 Nov 1975).

Using the time-of-flight technique, energy distribution measurements were made of the fusion produced alpha particles emitted from laser implosions of DT gas contained in glass microshells. The number of nuclear reactions was determined by an absolute measurement of both the number of alpha particles and the number of neutrons. From the FWHM of the alpha particle energy distributions, upper limits of the plasmas ion temperature have been inferred. By applying corrections for the broadening of the distribution due to the fuel and the pusher, ion temperatures of 2-3 keV have been calculated. These measurements constitute significant evidence that the implosions produced thermonuclear burn of the DT fuel. (auth)

7042 PROGRESS IN THE TOKAMAK RESEARCH. Kadomtsev, B. B. (Inst. of Atomic Energy, Moscow). pp 1-19 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

A brief survey is given of recent research studies carried out at the Kurchatov Institute. Some plasma parameters obtained so far are as follows. The electron temperature is about 3 keV, ion temperature ~0.7 keV, energy containment time ~0.02 sec, density up to 7×10^{15} cm^{-3}. The highest value of $n\tau_E$ is approximately 10^{12}. All these parameters can be obtained with simple and quiescent heating of an initially cold gas by current flowing through the plasma. (MOW)

7043 DIFFUSION IN TOROIDS: A REVIEW. Bickerton, R. J. (Culham Lab., Abington, Eng.). pp 37-50 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

A review of theoretical and experimental work on plasma diffusion in all types of toroidal thermonuclear devices is given. Classical and neo-classical containment theory was applied to stellarators, multipoles, and tokamak devices. (MOW)

7044 TOKAMACS WITH NON-CIRCULAR CROSS-SECTION. Laval, G.; Pellat, R. (Ecole Polytechnique, Paris). pp 64-80 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

The performance of ohmic heating in discharges of the tokamak type with a noncircular cross section is theoretically investigated. The advantage of such a system is shown. Plasma equilibrium, diffusion, and instabilities are discussed. (MOW)

7045 HIGH-BETA PLASMAS: PRESENT STATE AND PROSPECTS. Lotz, W. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). pp 109-121 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

At present beta-values between 0.1 and 1 and ion temperatures around 10 keV have been achieved with high-beta experiments, but confinement times are still much too low. In order to increase confinement times, a number of toroidal field configurations are being investigated: Screw-Pinch, Belt-Pinch, Reversed Pinch, and High-Beta Stellarator. Progress has been made in recent years and more and more is hoped for in the future. High-beta experiments as well as low-beta experiments have still a long way to go for the fusion reactor. (auth)

7046 EXPERIMENTS ON THE CONFINEMENT OF COLLISIONAL PLASMAS IN MIRROR TRAPS. Baiborodov, Yu. T.; Gott, Yu. V.; Ioffe, M. S.; Kanaev, B. I.; Yushmanov, E. E. (Inst.

of Atomic Energy, Moscow). pp 122-135 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

Experimental studies carried out in the PR-6 and PR-7 devices to investigate the stability and confinement of hot-ion mirror plasma in the collisional regime are described. They are compared with similar results obtained with 2 × II and DECA II. (MOW)

7047 THERMONUCLEAR FUSION IN INSTALLATIONS WITH A DENSE PLASMA. Budker, G. I. (Inst. of Nuclear Physics, Novosibirsk, USSR). pp 136-158 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

A review of research at Novosibirsk dealing with dense plasma confinement is given. The various research studies involving pinch, mirror, and multiple mirror fields are discussed. (MOW)

7048 COLLECTIVE INTERACTION OF RELATIVISTIC BEAMS WITH A PLASMA. Fainberg, Ya. B.; Shapiro, V. D. pp 159-183 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

The possible methods of eliminating the processes decreasing the plasma beam interaction efficiency are discussed. Some possibilities of focusing and modulating high-power beams are described. The possibility of using the anomalous transformation of hf waves into lf ones for plasma heating by the beam is also discussed. (MOW)

7049 APPLICATIONS OF INTENSE RELATIVISTIC ELECTRON BEAMS TO CONTROLLED THERMONUCLEAR FUSION. Sudan, R. N. (Cornell Univ., Ithaca, NY). pp 184-199 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

The heating of magnetically confined plasma by intense relativistic electron beams is discussed in terms of two-stream instability heating and high-density plasma heating. Beam focusing for solid-target heating is described along with magnetic field shaping and electromagnetic and MHD instabilities. (MOW)

Plasma Diagnostics

7050 (COO-2180-5) MICROWAVE MEASUREMENTS OF ELECTRON DENSITY IN A SPHERICAL INERTIAL-ELECTROSTATIC CONFINEMENT SYSTEM USING SIX ION GUNS. Chan, A. I. Y. (Brigham Young Univ., Provo, Utah (USA)). Aug 1975. Contract AT(11-1)-2180. 145p. Dep. NTIS $7.00.

The electron density in a spherical inertial-electrostatic confinement device using six ion beams was studied with microwave techniques involving the fundamental and higher order cavity resonances. Thermal expansion problems were circumvented by switched operation of the device. The deuterium background pressure was found to be a dominant factor in determining n/sub e/ throughout the entire range of 0.4 to 10 milliTorr. With 1 mTorr pressure and 10 mA total ion current (at 20 to 40 keV) central electron densities of the order of 10^9 electrons/cm^3 were estimated, with total population of approximately 10^{10} electrons. No evidence of shell structure of the electron density was found, although the use of higher order modes to obtain better spatial resolution was precluded by the low magnitude of n/sub e/. Indirect indication of weak ion trapping was obtained by measurement of the enhancement of neutron flux that resulted when the guns were operated simultaneously. (auth)

7051 (COO-2180-6) MEASUREMENTS OF NEUTRON FLUX FROM AN INERTIAL-ELECTROSTATIC CONFINEMENT DEVICE. Westenskow, G. A. (Brigham Young Univ., Provo, Utah (USA)). Aug 1975. Contract AT(11-1)-2180. 50p. Dep. NTIS $5.00.

A neutron-detection system was built for the purpose of measuring the neutron flux from an Inertial-Electrostatic Confinement Device located at Brigham Young University. A BF_3 proportional counter was used for absolute flux measurements and a pair of scintillation detectors was used to compare neutron output under different operating conditions. The detectors were designed to be compatible with the operating conditions of the device and to be able to measure small changes in neutron output. The detectors were calibrated using a Pu-Be source with corrections made for laboratory conditions. Performance of the counting system was checked and data were collected on the neutron flux from the device. (auth)

7052 (IPP-1/155) PRODUCTION OF HIGH-FREQUENCY MODULATED LIGHT PULSES FOR THE MEASUREMENT OF THE FREQUENCY RESPONSE OF INFRARED DETECTORS. Braun, W.; Roehr, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Aug 1975. 13p. (In German). Dep. NTIS (US Sales Only) $4.50.

By means of a rotating mirror inserted into both branches of an interferometer, which is illuminated by laser light, two monochromatic light beams with different frequencies are produced. The superposition results in a beat signal with well-known degree of modulation. Beat frequencies up to 530 MHz at $\lambda = 10, 6\ \mu m$ were achieved. In a first application the frequency response of two high speed Ge : Hg detectors was investigated. (auth)

7053 (IPP-3/17) DENSITY DISTRIBUTION MEASUREMENTS IN LARGE C.T.R. DEVICES. Lisitano, G.; Morandi, P.; Cannici, B.; Rossetti, E.; Gottardi, N. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). May 1975. 49p. INIS.

From course on plasma diagnostics and data acquisition systems; Varenna, Italy (3 Sep 1975).

25 figs.; 16 refs.

Multichannel millimetre wave interferometry has been successfully applied to existing Tokamak discharges. The extension of this technique to the planned larger Controlled Thermonuclear Reactor (C.T.R.) devices presents some technical problems which are discussed on hand of the experience gained in present day devices. (auth)

7054 (ORNL-TM-5022) HARD X-RAY DETECTION SYSTEM FOR ORMAK. Knoepfel, H. E.; Renk, T.; Zweben, S. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 31p. Dep. NTIS $4.00.

Some of the basic problems connected with the measurements of hard bremsstrahlung, as they appear in following the x-ray from the target to the detector and beyond, are described. Finally, procedures are presented for unfolding experimental (scintillation) spectra into the original electron distribution function. (MOW)

7055 (UCRL-77247) ULTRA-FAST IMAGE CONVERTER STREAK CAMERAS FOR LASER FUSION DIAGNOSTICS. Houghton, J. W.; Thomas, S. W.; Attwood, D. T.; Coleman, L. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Nov 1975. Contract W-7405-Eng-48. 6p. (CONF-751125-21). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The design and operation of a 10-ps resolution optical streak camera used to characterize laser pulses and other transient optical signals in fusion research is discussed. Performance characteristics are presented. The design, operation, and application of an x-ray streak camera used to study laser-produced plasmas in the x-ray spectral region of 1 to 10 keV with temporal and spatial resolutions of approximately 20 ps and approximately 10 mu m is also discussed. (auth)

7056 (UCRL-77478) MICROPROCESSOR SYSTEM TO RECOVER DATA FROM A SELF-SCANNING PHOTODIODE ARRAY. Koppel, L. N.; Gadd, T. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Nov 1975. Contract W-7405-Eng-48. 7p. (CONF-751116-5). Dep. NTIS $4.50.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

A microprocessor system developed at Lawrence Livermore Laboratory has expedited the recovery of data describing the low energy x-ray spectra radiated by laser-fusion targets. An Intel microprocessor controls the digitization and scanning of the data stream of an x-ray-sensitive self-scanning photodiode array incorporated in a crystal diffraction spectrometer. (auth)

7057 (UCRL-77504) 2XIIB COMPUTER DATA ACQUISITION SYSTEM. Tyler, G. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Nov 1975. 15p. (CONF-751125-16). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

All major plasma diagnostic measurements from the 2XIIB experiment are recorded, digitized, and stored by the computer data acquisition system. The raw data is then examined, correlated, reduced, and useful portions are quickly retrieved which direct the future conduct of the plasma experiment. This is done in real time and on line while the data is current. The immediate availability of this pertinent data has accelerated the rate at which

the 2XII personnel have been able to gain knowledge in the study of plasma containment and fusion interaction. The up time of the experiment is being used much more effectively than ever before. This paper describes the hardware configuration of our data system in relation to various plasma parameters measured, the advantages of powerful software routines to reduce and correlate the data, the present plans for expansion of the system, and the problems we have had to overcome in certain areas to meet our original goals. (auth)

7058 LIGHT SCATTERING MEASUREMENTS IN THE STATIONARY PLASMA OF A CASCADE ARC. Gieres, G. Aachen; Technische Hochschule (1973). 74p. (In German). INIS.

Thesis.

By means of light scattering measurements, the problem of whether stationary arc discharges in a helium or deuterium atmosphere are in local thermodynamic equilibrium was clarified. The electron temperatures and densities were determined in the 90° scattering experiment from the form of the measured scattering profiles as well as from the total scattering intensity. The results of the light scattering measurements in the case of the helium discharges were compared with spectroscopic "end-on" measurements. According to this, the discharges are not in equilibrium. In order to answer the question of whether an enlargement of the arc discharge plays a role in the gaps between the cascade plates, additional spectroscopic "side-on" measurements were carried out. (GE)

Plasma Kinetics (General)

7059 (CEA-R-4662) EXPERIMENTAL AND THEORETICAL STUDY OF HELICAL EXPLOSIVE ELECTRICAL CURRENT GENERATORS WITH MAGNETIC FIELD COMPRESSION. Antoni, B.; Nazet, C. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Jul 1975. 75p. (In French). Dep. NTIS (US Sales Only) $5.50.

A generator of electrical energy is described in which magnetic field compression is achieved by a solid explosive. The magnetic flux losses were calculated for generators of various configurations by the skin depth concept. Calculations take the joule heating of conductors into account. In helical generators the magnetic flux losses are higher than those calculated by considering diffusion only. Additional losses approximately as important as diffusion losses have already been observed elsewhere on similar devices. It is shown by detailed calculations of the motion of the explosively driven inner conductor that losses come from the jumps encountered by sliding contact moving along the helix. The jumps are caused by little geometrical defects and the consequence on losses is strongly dependent on current intensity. The jumps decrease when the pitch of helix increases which explains how they can disappear in coaxial generators; this is confirmed experimentally. The jumps are detrimental to the efficient use of the explosive energy. With helical generators only 5% of the energy is transferred into magnetic energy. (auth)

7060 (IPP-Libr-42) QUARTERLY TITLE LIST FOR THE PERIOD ENDING JUNE 1975. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). 1975. 38p. INIS.

A list of the laboratory reports issued the publications made, the articles submitted for publication as well as the lectures held are dealt with. Abstracts of the works are to a large extent included with the titles. (GE)

7061 (MATT-1174) CONFERENCE REPORT FOR NUCLEAR FUSION PHENOMENA IN IONIZED GASES. Porkolab, M. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Oct 1975. Contract E(11-1)-3073. 14p. Dep. NTIS $4.00.

A summary of the Conference on Phenomena in Ionized Gases, held in Eindhoven, The Netherlands, is given. In particular, the format of the conference and the content of the review papers are summarized. (auth)

7062 (N-74-21341) RESEARCH ACTIVITIES OF THE INSTITUTE OF PLASMA PHYSICS. Annual Report, 1972. (Stuttgart Univ. (TH) (F.R. Germany). Inst. fuer Plasmaforschung). 1973. 92p. NTIS $7.75.

A survey of scientific work carried out during the year 1972 is presented. The research program was narrowed down to some main problem areas, such as plasma waves, plasma focusing, transient diagnostics, and laser applications. (GRA)

7063 (N-75-16354) PLASMA PHENOMENA AT MAGNETIC NEUTRAL POINTS. Final Report. Sturrock, P. A. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Feb 1975. 25p. (NASA-CR-142059). NTIS $3.25.

A model of the plasma focus is considered, in which large axial electric fields are induced by the imploding current sheet during the final few nanoseconds of the collapse phase. This field provides a mechanism for creation of a beam of electrons of highly suprathermal energies. For this beam, the bremsstrahlung radiation is calculated, which is expected either from electron-deuteron collisions in the focused plasma itself or from the beam as it reaches the walls of the device. Comparison with experimental results indicates that the walls are the more likely source of these hard x-rays and also find qualitative agreement of the expected angular distribution of x-rays with experiment. (auth) (STAR)

7064 (SAND-75-5747) Z/sub e/ It 1OMEGA PINCHED ELECTRON DIODES. Poukey, J. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 9p. (CONF-751108-2). Dep. NTIS $4.50.

From 1st international topical conference on electron beam research and technology; Albuquerque, New Mexico, USA (3 Nov 1975).

High current pinched electron flow in diodes is shown to be self-limiting, in the sense that for given diode voltage the electron current approaches a limiting value as R/d (cathode radius/gap) yields infinity. The consequence is that in order to achieve electron impedances Z/sub e/ less than 1 OMEGA, one may have to inject high-atomic-weight plasma into the diode. (auth)

7065 (UCRL-77024) INTENSE SYNCHROTRON RADIATION FROM A MAGNETICALLY COMPRESSED RELATIVISTIC ELECTRON LAYER. Shearer, J. W.; Nowak, D. A.; Garellis, E.; Condit, W. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1975. Contract W-7405-Eng-48. 27p. (CONF-751108-1). Dep. NTIS $4.50.

From 1st international topical conference on electron beam research and technology; Albuquerque, New Mexico, USA (3 Nov 1975).

Using a simple model of a relativistic electron layer rotating in an axial magnetic field, energy gain by an increasing magnetic field and energy loss by synchrotron radiation were considered. For a typical example, initial conditions were approximately 8 MeV electron in approximately 14 kG magnetic field, at a layer radius of approximately 20 mm, and final conditions were approximately 4 MG magnetic field approximately 100 MeV electron layer energy at a layer radius of approximately 1.0 mm. In the final state, the intense 1-10 keV synchrotron radiation imposes an electron energy loss time constant of approximately 100 nanoseconds. In order to achieve these conditions in practice, the magnetic field must be compressed by an imploding conducting liner; preferably two flying rings in order to allow the synchrotron radiation to escape through the midplane. The synchrotron radiation loss rate imposes a lower limit to the liner implosion velocity required to achieve a given final electron energy (approximately 1 cm/mu sec in the above example). In addition, if the electron ring can be made sufficiently strong (field reversed), the synchrotron radiation would be a unique source of high intensity soft x-radiation. (auth)

7066 SIXTH EUROPEAN CONFERENCE ON CONTROLLED FUSION AND PLASMA PHYSICS. Vol. II. Invited Papers and Supplementary Papers. Proceedings of a Symposium Held July 30—August 4, 1973, at Moscow, USSR. Dubna, USSR; Joint Institute for Nuclear Research (1974). 486p. (CONF-730705-P2).

Separate abstracts for 15 of the papers are included in Nuclear Science Abstracts. Four abstracts were prepared for ERDA Research Abstracts. (MOW)

For abstracts of individual papers see: 7042—7049, 7070, and 7159—7164.

Plasma Kinetics (Theoretical)

Refer also to abstract 7079.

7067 (COO-3070-130) STABILITY ANALYSIS OF A FINITE DIFFERENCE SCHEME USING SYMBOLIC COMPUTATION. Reiman, A.; Bers, A. (Massachusetts Inst. of Tech., Cambridge (USA)). Jun 1975. 5p. (CONF-750606-8). Dep. NTIS $4.50.

From 7th conference on numerical simulation of plasmas; New York, New York, USA (2 Jun 1975).

Computer aided symbolic manipulation has previously been used in studies of weakly nonlinear behavior in plasmas. The application of such symbolic manipulation techniques to the study of the stability of a specific finite difference scheme is investigated. Eigenvalue calculations for the Von Neumann matrix are described. (MOW)

7068 (IPP-III-19) PRESSURE BALANCE BETWEEN A MAGNETIZED PLASMA AND A LOW PRESSURE NEUTRAL GAS. Shioda, S. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Sep 1975. 13p. Dep. NTIS (US Sales Only) $4.50.

The steady state pressure balance between a plasma and a low pressure neutral gas is calculated by the continuum approach in order to predict the critical density of a neutral gas above which the plasma is drastically affected. The diffusion in the plasma–neutral gas boundary induces a large diamagnetic current which also induces the large pressure difference between a plasma and a neutral gas. This means that a plasma may be affected even by a low density neutral gas. (auth)

7069 (IPP-6/135) INVESTIGATIONS OF THE MONOTONY OF DIFFERENCE SCHEMES FOR DIFFUSION EQUATIONS. Steuerwald, J. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Apr 1975. 50p. (In German). INIS.

1 fig.; 3 tabs.; 26 refs.

The aim of this study is to develop a general theory of the monotony of difference schemes for a certain class of diffusion equations. It is shown that this problem is contained in the more comprehensive general boundary value problem for parabolic differential equations. It was thus possible to enlist and adapt the known estimates for weakly coupled systems of diffusion equations. A similar method can be applied to prove the monotony of strongly coupled systems of diffusion equations. To ensure its validity, the set of solutions has to be restricted. The estimates obtained were checked on a system of strongly coupled diffusion equations from plasma physics. As already discussed elsewhere in the literature, it was found that a certain amount of caution should be exercised in choosing the step sizes. (auth)

7070 PLASMA ACCELERATORS. Morozov, A. I. (Inst. of Atomic Energy, Moscow). pp 285-305 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

The acceleration processes and electrostatic fields in the plasma are discussed. Theoretical discussions are given for single-lens and multiple-lens accelerators. (MOW)

7071 RENORMALIZED PROJECTION OPERATOR TECHNIQUE FOR NONLINEAR STOCHASTIC EQUATIONS. III. LoDato, V. A. (Marist Coll. Research Inst., Poughkeepsie, NY). J. Math. Phys. (N. Y.); 16: No. 10, 2012-2016(Oct 1975).

7072 SIMULATION OF PITCH ANGLE DIFFUSION OF CHARGED PARTICLES IN A DISORDERED MAGNETIC FIELD. Kaiser, T. B. (Goddard Space Flight Center, Greenbelt, MD). pp 203-205 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Results are reported for computer simulation experiments in which a statistical ensemble of random magnetic field realizations is generated, orbits of charged particles in the random fields are followed, and a pitch-angle diffusion coefficient is derived from the temporal evolution of the orbits. Diffusion coefficients predicted by three nonlinear theories are compared with the derived coefficients for the standard quasilinear theory of velocity diffusion, and the goals of future simulations are outlined. (IAA)

Plasma Production

7073 (UCRL-77230) FROZEN AMMONIA MICROPELLET GENERATOR FOR BASEBALL II-T. Denhoy, B. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Oct 1975. Contract W-7405-Eng-48. 7p. (CONF-751125-6). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A "startup" plasma at the center of the Baseball II-T magnet was studied. This startup plasma will be used as a target for high energy neutral beams to achieve the required build-up. The target plasma will be created by irradiating a solid pellet with a laser beam. Although a deuterium pellet would be superior because of purity, the development of an ammonia pellet was undertaken because it requires a simpler technology. The ammonia target plasma is physically acceptable for the initial experiment. A frozen ammonia pellet, about 100 mu m in diameter, will be irradiated with 300-J CO_2 laser, to produce a density of about 10^{13} cm^{-3} and about 1 kV temperature. (auth)

Plasma Stability

7074 (IPP-1/152) STATE OF THE MHD STABILITY THEORY OF AXISYMMETRIC TOROIDAL EQUILIBRIA WITH CIRCULAR AND ELONGATED PLASMA CROSS SECTIONS. Gruber, O. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1975. 30p. (In German). INIS.

10 figs.; 27 refs.

A survey of the MHD stability of axisymmetric toroidal equilibria with circular and "vertical", non-circular plasma cross-sections is given. The influence of the toroidal current density distribution, the diamagnetic poloidal currents, the plasma conductivity and the toroidal aspect ratio is discussed. A comparison of noncircular with circular cross-sections shows the same stability behavior of the internal kink modes. Furthermore, the stability of localized modes is improved if diamagnetic currents (necessary for high-β values) and D-shaped cross-sections are taken into account. Stabilization of both modes calls for a q-value on the magnetic axis of about unity. To stabilize the external kink modes, both adequate shear (vanishing current density at the plasma surface) as in a circular cross-section and small curvature at the ends of the elongated plasma cross-section are necessary. The stabilizing effect of diamagnetic poloidal currents also exists for the external modes except for the surface current model. (GE)

7075 (IPP-1/153) FINITE-β STABILIZATION OF A DIFFUSE HELICAL l = MHD EQUILIBRIUM. Herrnegger, F.; Neuhrenberg, J. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Apr 1975. 15p. INIS.

6 figs.; 11 refs.

The stability of helically symmetric finite-β, l = 1 magnetohydrostatic equilibria with arbitrary pressure profile and vanishing longitudinal current is investigated by means of Mercier's criterion, a sufficient criterion by Lortz, Rebhan and Spies, and Shafranov's condition for a high-β magnetic well. The new finite-β effects are that (1) a magnetic well is created throughout the plasma region for 0.2 approximately < β approximately < 0.95 and 0.3 approximately < a tau approximately < 0.6 (a plasma radius, tau torsion of the magnetic axis); (2) the mean magnetic well extends out into vacuum region for 0.75 approximately < β and b tau approximately < 0.6 (b wall radius); (3) with the exception of a very narrow region (< 0.1 a τ) around the magnetic axis, the Mercier criterion is satisfied for 0.75 approximately < β approximately < 0.95 and 0.12 approximately < a τ approximately < 0.3. (auth)

7076 (IPP-6/134) MAGNETOHYDRODYNAMIC INSTABILITIES FOR TOKAMAKS WITH NONCIRCULAR CROSS SECTION. Kerner, W. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1975. 53p. INIS.

21 figs.; 31 refs.

The stability behavior of a class of exact tokamak equilibria is investigated in the context of ideal magnetohydrodynamics. The equilibria have an almost constant volume current in the toroidal direction and also a poloidal current which produces a diamagnetic or paramagnetic current distribution. The plasma cross sections are roughly elliptic. The plasma is surrounded by a vacuum extending to a perfectly conducting wall. Stability is investigated by means of the energy principle. Suitable test functions are used to detect unstable perturbations and to determine the respective growth rates. The calculation involves no approximations, and so all parameters of the equilibrium solution can be arbitrarily varied. In this method only the stability limit is undetermined. With a free plasma boundary instabilities occur below and above the Kruskal–Shafranov limit for every aspect ratio investigated (i.e., $\epsilon^{-1} > 5$). Equilibria with highly elliptic cross sections generally involve more instabilities than those with circular cross sections. In order to attain a high degree of accuracy, extensive algebraic calculations are done by computer using the REDUCE programming language. (auth)

7077 (IPP-6/137) TRAPPED ION DEPLETION BY ANOMALOUS DIFFUSION DUE TO THE DISSIPATIVE TRAPPED ION INSTABILITY. Wimmel, H. K. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jul 1975. 27p. Dep. NTIS (US Sales Only) $5.00.

At high temperatures the KADOMTSEV - POGUTSE diffusion in tokamaks can become so large as to cause depletion of trapped ions if these are replaced with free ions by means of collisions rather than being directly recycled or injected. Modified KA-

DOMTSEV - POGUTSE diffusion formulas are employed in order to estimate this effect in the cases of classical and anomalous collisions. The maximum trapped-ion depletion is estimated from the PENROSE stability condition. For anomalous collisions a BOHM - type diffusion is derived. Numerical examples are given for JET-like parameters (JET = Joint European Torus). Depletion is found to reduce diffusion by factors of up to 10 and more. (auth)

7078 (IPP-6/138) SELF CONSISTENT TIME DEPENDENT MHD TOROIDAL FLOW WITH FINITE RESISTIVITY AND VISCOSITY. Chrisman, P. W.; von Hagenow, K. U.; McCune, J. E. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany); Massachusetts Inst. of Tech., Cambridge (USA)). Aug 1975. Contract E(11-1)-3070. 44p. Dep. NTIS $5.00.

A multiple-time-scale treatment of the development of a Tokamak discharge in the collisional regime is presented. Self-consistent, resistive, finite-β, MHD equations are used, with inertial and viscous effects included to obtain stabilization of the well-known poloidal spin-up. This stabilization occurs at a plasma state such that the geodesic speed remains subsonic. Only resistive (diffusive) time scales are considered. On the fast, cylindrical, skin time, the field penetrates the plasma, and the poloidal spin-up instability arises and then saturates due to viscosity. On the slower, toroidal, skin time, the plasma would move across the field, and the final density and pressure profiles develop. In addition, toroidal angular momentum would build up to a value depending on the extent of poloidal rotation. Present experiments, however, are unlikely to operate long enough to reach this final state. (auth)

7079 (LA-6130-MS) VLASOV-FLUID MODEL WITH ELECTRON PRESSURE. Gerwin, R. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1975. Contract W-7405-ENG-36. 11p. Dep. NTIS $4.00.

The Vlasov-ion, fluid-electron model of Freidberg for studying the linear stability of hot-ion pinch configurations is here extended to include electron pressure. Within the framework of an adiabatic electron-gas picture, it is shown that this model is still amenable to the numerical methods described by Lewis and Freidberg. (auth)

7080 (MATT-1167) INHIBITION OF THE CURRENT-DRIVEN ION WAVE INSTABILITY BY ELECTRON TRAPPING IN THE FM-1 SPHERATOR. Arunasalam, V.; Okabayaski, M.; Hawryluk, R. J.; Suckewer, S. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Oct 1975. Contract E(11-1)-3073. 13p. Dep. NTIS $4.00.

An experimental analysis is made of the scattering of microwaves by the density fluctuations due to the current-driven ion wave instability in a toroidal plasma confinement device, the FM-1 spherator. It is found that the instability exists in the collisional regime and it is inhibited (i.e., quenched by two orders in magnitude) in the trapped-electron (i.e., banana) regime. The inhibition occurs when the electron collision frequency is about equal to the electron bounce frequency between mirror trapping. (auth)

7081 (MATT-1169) SATURATION OF THE PARAMETRIC DECAY INSTABILITY NEAR THE LOWER HYBRID FREQUENCY. Chen, L.; Berger, R. L. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Oct 1975. Contract E(11-1)-3073. 13p. Dep. NTIS $4.00.

The nonlinear evolution and saturation of parametrically excited lower hybrid waves are studied numerically by solving the corresponding weak turbulence wave kinetic equation. The saturation level and the effective collision frequency nu/sub f/ are obtained as functions of pump power. (auth)

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Refer also to abstracts 7176, 7177, and 7249.

7082 (ANL-Trans-1022) SIMPLIFIED THEORY OF HIGH EFFICIENCY INDUCTIVE TRANSFER PROCESSES. Rioux, C. Translated from Rev. Phys. Appl.; 10: No. 2, 75-79(Mar 1975). 12p. Dep. NTIS $4.50.

A system using only inductances and opening and closing switches has been developed to transfer energy from a storage inductance to any given load with a very high efficiency. Even higher efficiencies can be achieved if a number of small capacitors are used. (auth)

7083 (BNL--20581) HIGH-ENERGY NEUTRON IRRADIATION OF SUPERCONDUCTING COMPOUNDS. Sweedler, A. R.; Snead, C. L.; Newkirk, L.; Valencia, F.; Geballe, T. H.; Schwall, R. H.; Matthias, B. T.; Corenswit, E. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 17p. (CONF-751026--33). Dep. NTIS $4.50.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (30 Sep 1975).

The effect of high-energy neutron irradiation (E greater than 1 MeV) at ambient reactor temperatures on the superconducting properties of a variety of superconducting compounds is reported. The materials studied include the A-15 compounds Nb_3Sn, Nb_3Al, Nb_3Ga, Nb_3Ge and V_3Si, the C-15 Laves phase HfV_2, the ternary molybdenum sulfide $Mo_3Pb_{0.5}S_4$ and the layered dichalcogenide $NbSe_2$. The superconducting transition temperature has been measured for all of the above materials for neutron fluences up to 5×10^{19} n/cm^2. The critical current for multifilamentary Nb_3Sn has also been determined for fields up to 16 T and fluences between 3×10^{17} n/cm^2 and 1.1×10^{19} n/cm^2. (auth)

7084 (BNWL-1938) ANALYSIS OF TRITIUM RELEASES TO THE ATMOSPHERE BY A CTR. Renne, D. S.; Sandusky, W. F.; Dana, M. T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Oct 1975. Contract E(45-1)-1830. 54p. Dep. NTIS $5.45.

Removal by atmospheric processes of routinely and accidentally released tritium from a controlled thermonuclear reactor (CTR) was investigated. Based on previous studies, the assumed form of the tritium for this analysis was HTO, or tritiated water vapor. Assuming a CTR operation in Morris, Illinois, surface water and ground-level air concentration values of tritium were computed for three space (or time) scales: local (50 Km of a plant), regional (up to 1000 Km of the plant), and global. (auth)

7085 (BNWL-SA-5422) EFFECTS OF HELIUM IMPLANTED BY TRITIUM DECAY ON THE HIGH TEMPERATURE MECHANICAL PROPERTIES OF NIOBIUM. Atteridge, D. G.; Chariot, L. A.; Johnson, A. B.; Remark, J. F.; Westerman, R. E. (Batelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 19p. (CONF-751026-25). Dep. NTIS $4.50.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (1 Oct 1975).

The effects of helium on the high-temperature short-time tensile properties of commercial purity niobium are being determined as a first step toward attaining a better understanding of inert gas/metal matrix interactions on mechanical properties. The helium was implanted in the niobium through the use of the tritium transmutation to helium. Tritium diffused into the metal decayed to helium until the required helium concentration was reached. The tritium was then removed and the specimen tested. The tritium transmutation helium charging method was used in this study as charging rates approaching two years of simulated fusion reactor exposure life per charging month can be achieved and the method yields uniform helium charging into standard mechanical property specimens. (auth)

7086 (CONF-750949-9) HELIUM TRAPPING IN ALUMINUM AND SINTERED ALUMINUM POWDERS. Das, S. K.; Kaminsky, M.; Rossing, T. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 8p. Dep. NTIS $4.50.

From international conference on ion beam surface layer analysis; Karlsruhe, F. R. Germany (15 Sep 1975).

The surface erosion of annealed aluminum and of sintered aluminum powder (SAP) due to blistering from implantation of 100-keV $^4He^+$ ions at room temperature has been investigated. A substantial reduction in the blistering erosion rate in SAP was observed from that in pure annealed aluminum. In order to determine whether the observed reduction in blistering is due to enhanced helium trapping or due to helium released, the implanted helium profiles in annealed aluminum and in SAP have been studied by Rutherford backscattering. The results show that more helium is trapped in SAP than in aluminum for identical irradiation conditions. The observed reduction in erosion from helium blistering in SAP is more likely due to the dispersion of trapped helium at the large Al-Al_2O_3 interfaces and at the large grain boundaries in SAP than to helium release. (auth)

7087 (CONF-751101-57) HELIUM BLISTERING OF CERAMIC COATINGS ON HASTELLOY X AND Nb-1 PERCENT Zr. Kaminsky, M.; Das, S. K.; Ekern, R. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 15p. Dep. NTIS $4.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

The surface damage of insulating ceramic coatings on Hastelloy X and Nb-1 percent Zr held at room temperature and at 300°C was studied for both 100 keV and 250 keV helium ion irradiation for a dose range from 3.7×10^{18} to 1×10^{19} ions cm^{-2}. Blisters were observed after room temperature irradiation with both 100 keV and 250 keV helium ions. However, for irradiation at 300°C no blisters could be observed. The sharp rise in the helium permeation with temperature, observed by others for some glasses and ceramics, is thought to be responsible for this behavior. These results suggest that for the energy range studied helium blistering has a negligible surface erosion effect on such coatings if they are operated at temperatures above 300°C. (auth)

7088 (CONF-751125-7) ADVANCED FUSION FUELS. McNally, J. R. Jr. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Results of parametric studies of the reactivity of DD and D^6Li advanced fusion fuels are presented. Important control features are discussed. (auth)

7089 (CONF-751125-8) TOROIDAL FIELD RIPPLE EFFECTS IN LARGE TOKAMAKS. Uckan, N. A.; Tsang, K. T.; Callen, J. D. (Oak Ridge National Lab., Tenn. (USA)). 1975. 5p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

In an experimental power reactor, the ripple produced by the finite number of toroidal field coils destroys the ideal axisymmetry of the configuration and is responsible for additional particle trapping, loss regions and plasma transport. The effects of toroidal field ripple on the plasma transport coefficient, the loss of alpha particles and energetic injection ions, and the relaxation of toroidal flows are investigated in a new and systematic way. The relevant results are applied to the ORNL-EPR reference design; the maximum ripple there of about 2.2 percent at the outer edge of the plasma column is found to be tolerable from plasma physics considerations. (auth)

7090 (CONF-751125-14) VACUUM FOR A TOKAMAK EXPERIMENTAL FUSION POWER REACTOR. Moenich, J. S.; Fasolo, J. A.; Stevens, H. C. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 6p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A preliminary study was made of the vacuum system requirements for a D-T burning TEPR with major radius R equals 6.25 m and plasma radius a equals 2.1 m. Approximate requirements for the neutral injector vacuum system have been determined as functions of neutral beam power for a one-component, 180 keV D^0 beam derived from D^+. For the 40 MW reference design D^0 beam, the total injector gas load varies from approximately 500 to approximately 800 Torr-l/s as the assumed ion source gas efficiency varies from 40 to 25 percent. The torus or plasma containment vessel has 711 m^3 of volume and 592 m^2 of surface area. Material selection for the first wall will affect the total gas load available to be pumped. The toroidal pumping system must be able to reduce the pressure after the burn or fusion cycle from 10^{-3} Torr to 10^{-5} Torr or less in 10 to 15 s. Furthermore, before each experimental run, or possibly more often, this pumping system must be capable of evacuating the entire volume down to 1×10^{-8} Torr or less to assure a reasonably contamination free plasma. (auth)

7091 (CONF-751125-35) DESIGN OF THE METASTABLE ECCENTRIC COIL TEST. Luton, J. N.; Ballou, J. K. (Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The Eccentric Coil Test (ECT) described herein was a proposed facility for testing individual superconducting coils under conditions similar to those encountered by a toroidal field coil of a tokamak. In order to arrive at designs worthy of large scale proof testing, one needs the results of tests in a facility which (a) can separate the effects of the different variables, (b) has the possibility of pushing the test coil to "failure" in different waves, and (c) in which several different test coils can be studied without excessive costs in time or money. ECT consists of a relatively large background coil, a replaceable test coil, and small coils for the production of localized pulsed fields. The midplanes of the test and background coils are coincident, but their axes are displaced in order to provide asymmetric magnetic forces on the test coil. The background coil inside diameter is 89 cm; a variety of test coil sizes can be accommodated. Included in the discussion is the rationale of the test, objectives and requirements, a description of the apparatus, and predicted performance. (auth)

7092 (CONF-751125-36) EXPERIMENT TO MEASURE THE EFFECTS OF BIAXIAL STRAIN ON THE CRITICAL CURRENT OF NbTi SUPERCONDUCTOR. Froelich, K. J. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Twisted multifilament, copper-clad NbTi superconductors have been axially and biaxially strained at 4.2K with a 7.5T background field. A simply-constructed cryogenic loading frame was built and used to strain the conductor. Results on 1.27 mm x 3.13 mm conductor have shown that degradation of less than .3 percent of critical current occurred when the wire was biaxially strained to +3260 mu epsilon in the axial direction and -1875 mu epsilon in the transverse direction. Degradation approaches 3 percent of critical current at approximately 6000 mu epsilon in the axial direction only. (auth)

7093 (CONF-751125-38) PREPARATION AND EXTRUSION OF MULTIFILAMENTARY NbTi CONDUCTOR BILLETS. Fietz, W. A.; McDonald, R. E.; Miller, J. R. (Oak Ridge National Lab., Tenn. (USA)). 1975. 6p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

In a cooperative program with industrial superconducting wire manufacturers for the purpose of studying billet preparation and extrusion, a total of twenty billets were assembled. Fourteen of these contained no superconductor but were "dummy" billets to evaluate methods of stacking to achieve the best packing density. These billets were not extruded but were sectioned transversely and longitudinally for evaluation of billet preparation techniques. The remaining six billets were assembled with NbTi stacking elements in a copper/copper nickel matrix using a standard conductor configuration. Two of these billets were instrumented with thermocouples and used to evaluate preheating techniques. The other four were extruded and drawn to finished conductor size for critical current measurement. This study showed that hexagonal stacking elements, contoured billet jackets and hot isostatic pressing resulted in high density uniform billets for extrusion. Rotary forging was found to be unacceptable for billet compacting. Fast billet heating was achieved in both the salt bath and by induction heating, but the induction method gave a more uniform temperature distribution during the heating cycle. Asymmetry from poor packing density in the billet resulted in nonuniform filament size distributions and poor critical current performance. Billet yield was increased as much as 16 percent by contouring the stacking element positions within the billet. (auth)

7094 (CONF-751125-39) TRANSIENT POLOIDAL FIELD EFFECTS IN TWISTED MULTIFILAMENTARY SUPERCONDUCTOR FOR TOROIDAL FIELD WINDINGS OF TOKAMAKS. Shen, S. S.; Miller, J. R. (Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A circuit model is presented for a twisted filamentary superconductor exposed to a pulsed parallel external field. Experimental results are also reported on the measurements of transient loss voltage and its change due to transport current. The measurements are in reasonable agreement with that predicted by the postulated model. (auth)

7095 (CONF-751125-40) MAGNETIC SHIELDING SYSTEM FOR THE TOKAMAK EXPERIMENTAL POWER REACTOR. Marcus, F. B.; Peng, Y. K. M.; Dory, R. A.; Moore, J. R. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A poloidal field system is proposed for superconducting tokamaks which magnetically shields the toroidal field coil windings from pulsed fields and reduces the plasma inductive requirements. The principal elements of the system are a primary air core winding and a shield-vertical-field winding. The properties of the system are investigated using computer codes for MHD equilibrium, inductances, and fields. (auth)

7096 (CONF-751125-41) COMPARISON OF THE LEADING CANDIDATE COMBINATIONS OF BLANKET MATERIALS, THERMODYNAMIC CYCLES, AND TRITIUM SYSTEMS FOR FULL SCALE FUSION POWER PLANTS. Fraas, A. P. (Oak Ridge National Lab., Tenn. (USA)). 1975. 23p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The many possible combinations of blanket materials, tritium generation and recovery systems, and power conversion systems were surveyed and a comprehensive set of designs were generated by using a common set of ground rules that include all of the boundary conditions that could be envisioned for a full-scale commercial fusion power plant. Particular attention was given

to the effects of blanket temperature on power plant cycle efficiency and economics, the interdependence of the thermodynamic cycle and the tritium recovery system, and to thermal and pressure stresses in the blanket structure. The results indicate that, of the wide variety of systems that have been considered, the most promising employs lithium recirculated in a closed loop within a niobium blanket structure and cooled with boiling potassium or cesium. This approach gives the simplest and lowest cost tritium recovery system, the lowest pressure and thermal stresses, the simplest structure with the lowest probability of a leak, the greatest resistance to damage from a plasma energy dump, and the lowest rate of plasma contamination by either outgassing or sputtering. The only other blanket materials combination that appears fairly likely to give a satisfactory tritium generation and recovery system is a lithium-beryllium fluoride-Incoloy blanket, and even this system involves major uncertainties in the effectiveness, size, and cost of the tritium recovery system. Further, the Li_2BeF_4 blanket system has the disadvantage that the world reserves of beryllium are too limited to support a full-blown fusion reactor economy, its poor thermal conductivity leads to cooling difficulties and a requirement for a complex structure with intricate cooling passages, and this inherently leads to an expansive blanket with a relatively high probability of leaks. The other blanket materials combinations yield even less attractive systems. (auth)

7097 (CONF-751125-42) LARGE SUPERCONDUCTING COIL FABRICATION DEVELOPMENT. Brown, R. L.; Allred, E. L.; Anderson, W. C.; Burn, P. B.; Deaderick, R. I.; Henderson, G. M.; Marguerat, E. F. (Oak Ridge National Lab., Tenn. (USA)). 1975. 5p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Toroidal fields for some fusion devices will be produced by an array of large superconducting coils. Their size, space limitation, and field requirements dictate that they be high performance coils. Once installed, accessibility for maintenance and repairs is severely restricted; therefore, good reliability is an obvious necessity. Sufficient coil fabrication will be undertaken to develop and test methods that are reliable, fast, and economical. Industrial participation will be encouraged from the outset to insure smooth transition from development phases to production phases. Initially, practice equipment for three meter bore circular coils will be developed. Oval shape coil forms will be included in the practice facility later. Equipment that is more automated will be developed with the expectation of winding faster and obtaining good coil quality. Alternate types of coil construction, methods of winding and insulating, will be investigated. Handling and assembly problems will be studied. All technology developed must be feasible for scaling up when much larger coils are needed. Experimental power reactors may need coils having six meter or larger bores. (auth)

7098 (CONF-751125-43) MECHANICAL ENGINEERING PROBLEMS IN THE TFTR NEUTRAL BEAM SYSTEM. Cannon, D. D.; Bryant, E. H.; Johnson, R. L.; Kim, J.; Queen, C. C.; Schilling, G. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). 1975. 13p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A conceptual design of a prototype beam line for the TFTR Neutral Beam System has been developed. The basic components have been defined, cost estimates prepared, and the necessary development programs identified. Four major mechanical engineering problems, potential solutions and the required development programs are discussed. (auth)

7099 (CONF-751125-45) PHOTOELASTIC AND ANALYTICAL INVESTIGATION OF STRESS IN TOROIDAL MAGNETIC FIELD COILS. Pih, H.; Gray, W. H. (Oak Ridge National Lab., Tenn. (USA)). 1975. 6p. Dep. NTIS $4.00.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A series of two-dimensional photoelastic stress analyses on circular and oval toroidal magnetic field coils for fusion reactors were made. The circumferential variation of the coil's magnetic force was simulated by applying different pressures to sixteen segmented regions of the inner surface of the models. Isochromatics and isoclinics were measured at selected points on the loaded model in a transmission polariscope using a microphotometer. Separate principal stresses were obtained using the combination of photoelastic information and isopachic data measured from the solution of Laplace's equation by the electrical analog method. Analysis of the same coil geometries, loadings, and boundary conditions were made using the finite element method. General agreement between theory and experiment was realized. From this investigation several variations of coil geometry and methods of support were evaluated. Based upon this experiment, suggestions for optimum structural design of toroidal field coils are presented. (auth)

7100 (CONF-751125-46) SCOPING STUDIES OF TRITIUM HANDLING IN A TOKAMAK EXPERIMENTAL POWER REACTOR. Cherdack, R.; Watson, J. S.; Clinton, S. D.; Fisher, P. W. (Oak Ridge National Lab., Tenn. (USA)). 1975. 9p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Tritium handling techniques in an experimental fusion power reactor (EPR) are evaluated to determine the requirements of the system and to compare different equipment and techniques for meeting those requirements. Tritium process equipment is needed to (1) evacuate and maintain a vacuum in the plasma vessel and the neutral beam injectors, (2) purify and recycle tritium and deuterium for the plasma fuel cycle, (3) recover tritium from experimental breeding modules, and (4) provide tritium containment and atmospheric cleanup. A development program is outlined to develop and demonstrate the required techniques and equipment and to permit confident design of an EPR for operation by the mid-1980s. (auth)

7101 (CONF-751125-58) TOROIDAL SIMULATION MAGNET TESTS. Walstrom, P. L.; Domm, T. C. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). 1975. 5p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A number of different schemes for testing superconducting coils in a simulated tokamak environment are analyzed for their merits relative to a set of test criteria. Two of the concepts are examined in more detail: the so-called cluster test scheme, which employs two large background field coils, one on either side of the test coil; and the compact torus, a low-aspect ratio toroidal array of a small number of coils in which all of the coils are essentially test coils. Simulation of the pulsed fields of the tokamak is discussed briefly. (auth)

7102 (CONF-751125-60) OAK RIDGE EPR REFERENCE DESIGN. Roberts, M. (Oak Ridge National Lab., Tenn. (USA)). 1975. 5p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A Tokamak EPR reference design is presented as a basis for further study leading to a conceptual design. The set of basic plasma parameters selected, namely, minor radius of 2.25 m, major radius of 6.75 m, magnetic field on axis of 4.8 T and plasma current of 7.2 MA, should produce a reactor-grade plasma with a significant neutron flux even with the large uncertainty in plasma physics scaling from present experience to large sizes. Neutronics and heat transfer calculations coupled with mechanical design and materials considerations were used to develop a blanket and shield capable of operating at high temperature, protecting the surrounding coils, being maintained remotely and, in a few experimental modules, breeding tritium. The toroidal field coil design developed for a maximum field of 11 T at the winding combines the use of multifilamentary Nb_3Sn and NbTi superconducting cables (in high and low field regions, respectively) with forced flow of supercritical helium enclosed in a steel conduit. The poloidal magnetics system is specially designed both to reduce the total volt-second energy requirements and to reduce the rate of field change at the toroidal field coils. The reference design was synthesized from the information developed and evaluated in our prior scoping study. (auth)

7103 (CONF-751125-61) PHYSICS AND ENGINEERING ASPECTS OF THE OAK RIDGE EXPERIMENTAL POWER REACTOR. McAlees, D. G.; Bettis, E. S.; Huxford, T. J.; Marcus, F. B. (Oak Ridge National Lab., Tenn. (USA)). 1975. 5p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The first tokamak experimental power reactor (EPR) is planned for operation in the mid-1980's. The logic leading to the size of the ORNL reference reactor, the technical features of the plasma and energy conversion systems, and the predicted parameters consistent with several operating modes are discussed. The mechanical aspects of the blanket and shield systems and an evaluation of their nuclear performance including tritium breeding, nuclear heating and radiation damage are also given. (auth)

7104 (CONF-751125-62) MAGNETIC FIELD SHIELDING SYSTEM IN A TOKAMAK EXPERIMENTAL POWER REACTOR (EPR): CONCEPT AND CALCULATIONS. Peng, Y. K. M.; Marcus, F. B.; Dory, R. A.; Moore, J. R. (Oak Ridge National Lab., Tenn. (USA)). 1975. 4p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A poloidal magnetic field shielding system is proposed for a tokamak EPR. This coil system minimizes the pulsed poloidal field that intersects the TF (toroidal field) coils and hence reduces the risk of superconductor quenching and structural failure of the coils. Based on an idealized shielding model, we have determined the configurations for the OH (ohmic heating), the S-VF (shield-vertical field), and the T-VF (trimming-vertical field) coils in a typical tokamak EPR. It is found that the pulsed poloidal field strength is greatly reduced in the TF coil region. The overall requirement in stored plasma and vertical field energy is also substantially reduced when compared with conventional EPR designs. Use of this field shielding system is expected to enhance reliability of the superconducting TF coils in a tokamak EPR. (auth)

7105 (CONF-751125-63) ENGINEERING FEATURES OF ISX. Lousteau, D. C.; Jernigan, T. C.; Schaffer, M. J.; Hussung, R. O. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). 1975. 12p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

ISX, an Impurity Study Experiment, is presently being designed at Oak Ridge National Laboratory as a joint scientific effort between ORNL and General Atomic Company. ISX is a moderate size tokamak dedicated to the study of impurity production, diffusion, and control. The significant engineering features of this device are discussed. (auth)

7106 (CONF-751125-64) ISX TOROIDAL FIELD COIL DESIGN AND ANALYSIS. Hussung, R. O.; Lousteau, D. C.; Johnson, N. E.; Weed, R. A. (Oak Ridge National Lab., Tenn. (USA)). 1975. 18p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Structural design and analysis aspects of the toroidal field coils for the Impurity Study Experiment (ISX) tokamak are discussed. The overall mechanical design of ISX is predicated on the ability to remove the upper segment of the toroidal field coils to allow access to the toroidal vacuum vessel. The high current, 120 kA, capability of the new 74 MW power supply, coupled with the modest field requirement of ISX, allows the use of room temperature copper coils. Seventy-two turns, grouped into 18 coils, generate a magnet field of 18 kG at the major radius of 90 cm. Finite element structural analysis codes were utilized to determine the distribution of stresses and deflections around a typical turn. Initial material distribution on a coil was sized using the two-dimensional program FEATS. The resulting coil design was then coupled to the center bucking and out-of-plane restraint systems utilizing the NASTRAN code. The boundary conditions for the analytical models used in the two programs were then iterated, reaching satisfactory agreement as to stress contours and location for the joints. (auth)

7107 (CONF-751125-66) THERMAL ASPECTS OF A SUPERCONDUCTING COIL FOR FUSION REACTOR. Yeh, H. T. (Oak Ridge National Lab., Tenn. (USA)). 1975. 7p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Computer models are used to simulate both localized and extensive thermal excursions in a large superconducting magnet for fusion reactor. Conditions for the failure of fusion magnet due to thermal excursion are delineated. Designs to protect the magnet against such thermal excursion are evaluated. (auth)

7108 (CONF-751125-68) FIRST WALL COATINGS. Simpkins, J. E. (Oak Ridge National Lab., Tenn. (USA)). 1975. 3p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

As impurity problems become more significant, the selection of a suitable first wall material becomes more important. Many of the candidates are impractical either because they are difficult to fabricate or do not possess adequate strength. An alternate solution is a composite wall consisting of a suitable coating on a substrate chosen for its strength and ease of fabrication. Various techniques have been investigated for depositing a variety of candidate materials onto 304 L stainless steel. Thick coatings of several of these materials have been satisfactorily deposited utilizing ion plating. This technique is described in some detail. (auth)

7109 (ERDA-89) SUMMARY OF THE PROCEEDINGS OF THE WORKSHOP ON CONCEPTUAL DESIGN STUDIES OF EXPERIMENTAL POWER REACTOR-1. Murphy, M.; Neff, J. (eds.). (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Controlled Thermonuclear Research). Nov 1975. 81p. Dep. NTIS $5.45.

This document summarizes the proceedings of the first workshop which was convened to discuss the conceptual design of the EPR-I. The workshop, which was held September 9-10, 1975 at Oak Ridge, covered fifteen different topics relating to various reactor systems for EPR-I. The EPR scoping studied completed by ANL, GA and ORNL formed the basis of the discussions. In each of the session summaries, a discussion of the various designs, and of the R and D programs necessary to provide the technology base required for the designs, are discussed in varying detail. (auth)

7110 (GA-A-13665) SPUTTERING MEASUREMENTS ON CTR MATERIALS USING AUGER ELECTRON SPECTROSCOPY. Smith, J. N. Jr.; Meyer, C. H. Jr.; Layton, L. K. (General Atomic Co., San Diego, Calif. (USA)). 13 Oct 1975. Contract E(04-3)-167. 13p. (CONF-751101-58). Dep. NTIS $4.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

The sputter yield of Nb, W, C, and Ag by Ar^+ in the energy range from 0.5 to 1.5 keV was measured. In addition, the sputter yield for W, C and Ag by H^+ at 11.0 keV has been determined. With the exception of carbon, the data are in general agreement with earlier work. For carbon, some discrepancies between the present work and earlier studies are found. It is suggested that major factors contributing to these discrepancies are structural and/or chemical in nature. (auth)

7111 (IPP-4/30) A PRELIMINARY MODEL FOR ESTIMATING THE FIRST WALL LIFETIME OF A FUSION REACTOR. Daenner, W. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Feb 1975. 27p. INIS.

10 figs.; 13 refs.; with app.

The estimation of the first wall lifetime is a necessary basis for predicting the availability of a fusion power plant. In order to do this, an analytical model was prepared and programmed for the computer which calculates the temperature and stress load of the first wall from the principal design parameters and quotes them against the relevant material properties. Neither the analytical model nor the information about the material performance is yet complete so that the answers obtained from the program are very preliminary. This situation is underlined by the results of sample calculations performed for the CTRD blanket module cell. The results obtained for vanadium and vanadium alloys show a strong dependence of the lifetime on the irradiation creep and the ductility of these materials. Completion of this model is envisaged as soon as the missing information becomes available. (auth)

7112 (JUL-1208) PLASMA SCRAPE-OFF IN AXIAL-SYMMETRIC DIVERTOR. Gratzl, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Plasmaphysik). Jun 1975. 15p. Dep. NTIS (US Sales Only) $4.50.

In a toroidal guiding center plasma with hot ions and cold electrons at surface, the plasma scrape-off layer is computed from the drift orbits of magnetically untrapped ions that do not reach the collector plates of an axialsymmetric divertor. The scrape-off thickness is of the poloidal Larmor radius (R_p) order. (auth)

7113 (LA-5898-MS) PERFORMANCE OF STRUCTURED LASER FUSION PELLETS. Mason, R. J. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-ENG-36. 17p. Dep. NTIS $4.00.

Results are presented from an extensive study of the hydroburn response of bare DT shells, inert shells, and DT-filled microballoons to ramp-like, Gaussian, and square laser pulses. Scaling laws are determined for the best pulse energy and time scale for shells, as functions of their mass, aspect ratio and initial density. The advantages of DT ice over DT gas in the microballoons are demonstrated. An equivalence rule is established between linear ramp pulses and Gaussians, and a connection is drawn between the ramps and square pulses. Projections are made, via the scaling rules, to breakeven-plus pellet designs. The scaling rules are used to recommend pulses for pellets recently imploded at LASL and KMSF. The calculated performance of these targets is shown to agree, after adjustments, with the laboratory findings. Attention is drawn to practical problem areas in structured pellet design. (auth)

7114 (LA-6063) LASER-FUSION TARGET FABRICATION: APPLICATION OF A POLYMERIC ABLATOR COATING TO A BALL-AND-DISK TARGET DESIGN BY THE PHYSICAL VAPOR DEPOSITION OF POLYETHYLENE. Simonsic, G. A. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-ENG-36. 3p. Dep. NTIS $4.00.

A technique for applying polyethylene by physical vapor deposition is described. The ball-and-disk target design requires the application of a thin film of polyethylene on the front surface of the ball and substrate upon which the ball is mounted. Disk-shaped films, typically 20-mu m-diam by 1-mu m-thick, are successfully applied by this method. (auth)

7115 (LA-UR-75-2128) DIAGNOSIS OF UNDERDRYING IN PAPER CASTOR OIL CAPACITORS. Boicourt, G. P. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 8p. (CONF-751125-54). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Underdrying of the Kraft paper insulant in energy-storage capacitors can drastically shorten their life and even make them unsuitable for certain applications. When an underdryed capacitor fails in such an application, the user is often at a loss to know the reason since the diagnosis of underdrying is not an easy one to make. There are two phenomena whose appearance inside the windings of the failed capacitor, either singly or together, imply that the cause of failure was underdrying. These are margin spotting and margin arcs. These two diagnostic clues are discussed as is the empirical evidence connecting them to underdrying. Photographs showing their physical appearance are presented. A theoretical explanation is given which connects their presence to underdrying. (auth)

7116 (LA-UR-75-2129) HIGH VOLTAGE, HIGH CURRENT, PULSED ENERGY SOURCE HAVING dI/dt's OF 2 x 10^{12} A/s. Burkhardt, L. C.; Dike, R. S.; DiMarco, J. N.; Haarman, R. A.; Schofield, A. E. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 4p. (CONF-751125-51). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A hybrid transfer capacitor circuit, combining one back-biased and a forward-biased capacitor bank, plus a resistor (for damping and isolation) and an inductive load has achieved inductive-storage, explosive fuse-like rates of rise, and peak amplitudes, of currents. Initial dI/dt's of approximately 2 x 10^{12} A/s are measured, with currents in the 200 kA range. The combination of explosive fuses and magnetic energy storage has been successfully used at Los Alamos Scientific Laboratory to obtain currents with risetimes of 2 x 10^{12} A/s and of 200 kA magnitude, on both linear and toroidal Z pinches. Such a system must have the characteristic of initially high vector E fields during the formation of the pinch, but with low vector E fields along the plasma chamber's wall after the pinch has been formed. The voltage left on a simple capacitor system will cause secondary wall breakdown, which short-circuits the previously formed pinch. (Conceivably a crowbar of extremely low inductance could then remove the residual voltage; in practice, however, the attendant L/R decay time is too short for most pinch experiments.) (auth)

7117 (LA-UR-75-2153) ENGINEERING PROTOTYPES FOR THETA-PINCH DEVICES. Hansborough, L. D.; Hammer, C. F.; Hanks, K. W.; McDonald, T. E.; Nunnally, W. C. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 7p. (CONF-751125-47). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Past, present, and future engineering prototypes for theta-pinch plasma-physics devices at Los Alamos Scientific Laboratory are discussed. Engineering prototypes are designed to test and evaluate all components under system conditions expected on actual plasma-physics experimental devices. The importance of engineering prototype development increases as the size and complexity of the plasma-physics device increases. Past experiences with the Scyllac prototype and the Staged Theta-Pinch prototype are discussed and evaluated. The design of the proposed Staged Scyllac prototype and the Large Staged Scyllac implosion prototype assembly are discussed. (auth)

7118 (LA-UR-75-2154) IMPLOSION HEATING IN THE SCYLLAC FUSION TEST REACTOR. Lindord, R. K.; Nunnally, W. C.; Thomassen, K. I. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 6p. (CONF-751125-52). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The Scyllac Fusion Test Reactor (SFTR) is a large-radius toroidal theta-pinch experiment in the Controlled Thermonuclear Research program at the Los Alamos Scientific Laboratory. The SFTR is designed for D-T operation to achieve Q equals 1, i.e., the total neutron energy at 20 MeV/neutron is equal to the internal energy of the plasma with an expected average confinement time of the plasma in the range of 200 ms. One of the most important and technologically challenging systems in the SFTR is the implosion-heating system. This system provides the implosion-heating field which must rise to approximately 8 kG in 100 to 200 ns and then crow-barred with a sufficiently long L/R time to allow the compression field to be brought up. The system employs 54-kV capacitors as the energy source arranged in a low-inductance configuration in order to obtain a short risetime with a minimum of voltage and energy. This paper describes the design and discusses the expected operating performance of the implosion-heating system. (auth)

7119 (LA-UR-75-2158) SCYLLAC EQUIPMENT RELIABILITY ANALYSIS. Gutscher, W. D.; Johnson, K. J. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 5p. (CONF-751125-55). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Most of the failures in Scyllac can be related to crowbar trigger cable faults. A new cable has been designed, procured, and is currently undergoing evaluation. When the new cable has been proven, it will be worked into the system as quickly as possible without causing too much additional down time. The cable-tip problem may not be easy or even desirable to solve. A tightly fastened permanent connection that maximizes contact area would be more reliable than the plug-in type of connection in use now, but it would make system changes and repairs much more difficult. The balance of the failures have such a low occurrence rate that they do not cause much down time and no major effort is underway to eliminate them. Even though Scyllac was built as an experimental system and has many thousands of components, its reliability is very good. Because of this the experiment has been able to progress at a reasonable pace. (auth)

7120 (LA-UR-75-2183) FINAL INSTALLATION AND TESTING OF THE FEEDBACK POWER AMPLIFIER FOR THE SCYLLAC FEEDBACK EXPERIMENT. Kutac, K. J.; Kewish, R. W. Jr.; Gribble, R. F.; Rawcliffe, A. S.; Miller, G.; Kemp, E. L.; Bartsch, R. R. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 10p. (CONF-751125-53). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The Scyllac feedback system consists of eight subsystems. The installation and testing of the many components and eight subsystems are described. The eight subsystems are: (1) ML-8618 power amplifiers; (2) dc plate and bias power supplies; (3) ac filament power supplies; (4) position detector and signal processor (intermediate amplifier); (5) 1 equals 0 and 1 equals 2 output load coils; (6) control system and interlock system; (7) computer controlled analog-to-digital transient recorders; and (8) cable distribution and cooling-water supply system. (auth)

7121 (ORNL-5077) SCALING RELATIONS FOR EDDY CURRENT PHENOMENA. Dodd, C. V.; Deeds, W. E. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 38p. Dep. NTIS $4.00.

Formulas are given for various electromagnetic quantities for coils in the presence of conductors, with the scaling parameters factored out so that small-scale model experiments can be related to large-scale apparatus. Particular emphasis is given to such quantities as eddy current heating, forces, power, and induced magnetic fields. For axially symmetric problems, closed-form integrals are available for the vector potential and all the other quantities obtainable from it. For unsymmetrical problems, a three-dimensional relaxation program can be used to obtain the vector potential and then the derivable quantities. Data on experimental measurements are given to verify the validity of the scaling laws for forces, inductances, and impedances. Indirectly these also support the validity of the scaling of the vector potential and all of the other quantities obtained from it. (auth)

7122 (ORNL-TM-4820) DESCRIPTION OF A REFERENCE DESIGN TOKAMAK FOR THE TECHNOLOGY TEST ASSEMBLY. Haubenreich, P. N. (ed.). (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 125p. Dep. NTIS $5.45.

Early conceptual studies for the Technology Test Assembly involved a reference conceptual design for a tokamak with superconducting toroidal field magnets. The TF magnet conductors are NbTi filaments in a copper matrix. The 24 TF coils and associated structure operate at 4–5 K and a maximum field (at the windings) of 75 kG. Principal dimensions of the machine are: TF coil bore, 1.8 x 2.4 m (oval); major radius, 2.25 m; plasma minor radius, 0.6 m. A preliminary but detailed cost estimate for the reference machine was prepared to serve as an anchor point for cost scaling for larger machines in subsequent TTA parameter studies. (auth)

7123 (ORNL-TM-4999) COMPARATIVE STUDY OF THE MORE PROMISING COMBINATIONS OF BLANKET MATERIALS, POWER CONVERSION SYSTEMS, AND TRITIUM RECOVERY

AND CONTAINMENT SYSTEMS FOR FUSION REACTORS. Fraas, A. P. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 122p. Dep. NTIS $5.45.

The many possible combinations of blanket materials, tritium generation and recovery systems, and power conversion systems were surveyed first by reviewing the principal design studies that have been prepared and then by examining a comprehensive set of designs generated by using a common set of ground rules that included all of the boundary conditions that could be envisioned. The results indicate that, of the wide variety of systems that have been considered, by far the most promising employs lithium recirculated in a closed loop within a niobium blanket structure and cooled with boiling potassium or cesium. This approach gives the simplest and lowest cost tritium recovery system, the lowest pressure and thermal stresses, the simplest structure with the lowest probability of a leak, the greatest resistance to damage from a plasma energy dump, and the lowest rate of plasma contamination by either outgassing or sputtering. The only other blanket materials combination that appears fairly likely to give a satisfactory tritium generation and recovery system is an Li_2BeF_4-Incoloy blanket, and even this system involves major uncertainties in the effectiveness, size, and cost of the tritium recovery system. Further, the Li_2BeF_4 blanket system has the disadvantage that the world reserves of beryllium are too limited to support a full-blown fusion reactor economy, its poor thermal conductivity leads to cooling difficulties and a requirement for a complex structure with intricate cooling passages, and this inherently leads to an expensive blanket with a relatively high probability of leaks. The other blanket materials combinations yield even less attractive systems. (auth)

7124 (ORNL-TM-5036) CALCULATED PERFORMANCE OF VARIOUS STRUCTURAL MATERIALS IN FUSION-REACTOR BLANKETS. Williams, M. L.; Santoro, R. T.; Gabriel, T. A. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 27p. Dep. NTIS $5.00.

The calculated nuclear performances of niobium, SS-304, and nimonic-105 as structural materials in a conceptual D-T fusion-reactor blanket model are compared. For each structural material, the tritium breeding ratio, the energy-deposition rate, the operating dose, the time dependence of the neutron-induced activity, the time dependence of the dose from the activation products, the time dependence of the nuclear afterheat, and the atomic displacement rate are calculated. Emphasis is placed on the nuclear response in the first structural wall to the selected structural material for an assumed neutron wall loading of 1 MW/m^2. Taking into account all of the nuclear responses, SS-304 appears to be a reasonable choice as the structural material for fusion-reactor application. (auth)

7125 (ORNL-TM-5137) ENHANCEMENT FACTOR OF THE ELECTRIC FIELD IN THE POINT-PLANE CONFIGURATION. Westendorp, W. F. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 19p. Dep. NTIS $4.00.

In many dielectric tests a point and plane set of electrodes is used. The point may be tungsten and can be ground accurately to a cone of specified half angle. By grinding and etching the tip may be finished to a spherical shape. The radius may be determined by optical magnification. Given the cone half angle, the tip radius and the gap, it is of interest to find the enhancement factor, i.e., the ratio of the electric field at the tip to the average electric field within the gap. A modification of a technique is outlined, that permits the determination of the enhancement factor by computer for any practical cone angle and radius and for gap lengths of 1 cm and less. (auth)

7126 (SAND-75-5666) ELECTRON-BEAM FUSION TARGETS. Sweeney, M. A.; Clauser, M. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1975. 11p. (CONF-751130-2). Dep. NTIS $4.50.

From ASP meeting; St. Petersburg, Florida, USA (10 Nov 1975).

Computer studies of the behavior of targets composed of a low-Z ablator surrounding a gold pusher are described. The targets consisted of the following: (1) an ablator, the low-Z outer part of the shell where most of the beam energy is absorbed, (2) a pusher, the high-Z inner part of the shell which accelerates inward because of the high ablator pressure, and (3) the DT fuel, which is compressed and heated to thermonuclear temperatures by the imploding pusher. Some breakeven calculations are described. (MOW)

7127 (SAND-75-8679) HELIUM RE-EMISSION AND SURFACE DEFORMATION IN NIOBIUM DURING MULTIPLE TEMPERATURE HELIUM IMPLANTATION. Bauer, W.; Thomas, G. J. (Sandia Labs., Livermore, Calif. (USA)). Oct 1975. Contract AT(29-1)-789. 17p. (CONF-750949-8). Dep. NTIS $4.50.

From international conference on ion beam surface layer analysis; Karlsruhe, F. R. Germany (15 Sep 1975).

In previously published work, it was shown that helium implantation at high doses at temperatures of 400–700°C gave rise to relatively low helium re-emission and that the dominant mode of surface deformation consisted of flaking. On the other hand, during implantation at 1000°C and above, the helium re-emission approached 100 percent and a very stable mode of surface deformation consisting of holes was created. For CTR first wall applications, the high temperature case appears to be very favorable whereas the low temperature case is unacceptable. Helium re-emission and surface deformation in the low temperature range after high temperature exposure was studied. It was found that essentially no additional surface deformation occurred during low temperature helium implantation when the sample had been pre-exposed at 1200°C. Apparently the porous structure created during helium implantation at 1200°C gives rise to a significantly different helium sink distribution and this accounts for the radically different low temperature implantation behavior. (auth)

7128 (UCID-16940) DT FUSION NEUTRON IRRADIATION OF BPNL GRAPHITE IRRADIATION CAPSULE AND LLL NIOBIUM TENSILE SPECIMENS. MacLean, S. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Aug 1975. Contract W-7405-Eng-48. 8p. Dep. NTIS $4.00.

Test procedures for irradiating graphite and niobium tensile specimens with 14-MeV neutrons from the LLL Rotating Target Neutron Source are outlined. No test results are given. (MOW)

7129 (UCID-16942) DT FUSION NEUTRON IRRADIATION OF LLL COPPER TENSILE SPECIMENS AT 210°C. MacLean, S. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Sep 1975. Contract W-7405-Eng-48. 8p. Dep. NTIS $4.00.

Test procedures for irradiating five copper tensile specimens with 14-MeV neutrons from the LLL Rotating Target Neutron Source are outlined. No test results are given. (MOW)

7130 (UCRL-50002-74) CONTROLLED THERMONUCLEAR RESEARCH. Annual Report, July 1973–June 1974. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Oct 1974. Contract W-7405-Eng-48. 92p. Dep. NTIS $5.45.

The Controlled Thermonuclear Research (CTR) program at Lawrence Livermore Laboratory this year was marked by two major changes in the course of the experimental program: the adaption of high-power neutral beam heating in the 2X experiment, and the decision to change the startup mode in the Baseball II experiment to one in which a laser pellet technique is used to produce a transient, high-density target plasma. Supporting research centered on technologies vital to the mirror confinement program, e.g., development of intense neutral beams, of high-field superconducting magnets, and of direct energy conversion. In addition, a preliminary design study of fusion-fission hybrid systems was completed, as was a parametric study of mirror fusion reactors. The diverse experience of LLL in nuclear physics and materials research was applied to continuing 14-MeV neutron studies and tritium research. Much of the theory effort was devoted to the development of codes that describe the equilibrium of plasma under the assumption that only classical loss mechanisms prevail (both experimental and theoretical indications are that plasma loss at high density is dominated by these mechanisms). Also, both open-ended and toroidal two-component mirror systems have been studied. (auth)

7131 (UCRL-51929) SOME OPTIMIZATIONS OF THE ANIMAL CODE. Fletcher, W. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Oct 1975. Contract W-7405-Eng-48. 7p. Dep. NTIS $4.00.

Optimizing techniques were performed on a version of the ANIMAL code (MALAD1B) at the source-code (FORTRAN) level. Sample optimizing techniques and operations used in MALADOP--the optimized version of the code--are presented, along with a critique of some standard CDC 7600 optimizing techniques. The statistical analysis of total CPU time required for MALADOP and MALAD1B shows a run-time saving of 174 msec (almost 3 percent) in the code MALADOP during one time step. (auth)

7132 (UCRL-76341) CONTROL AND DATA MANAGEMENT FOR A LARGE FUSION LASER. Davis, J. W.; Holloway, F. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Nov 1975. 6p. (CONF-751125-15). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

SHIVA is a powerful (10-kJ 25 TW) neodymium glass laser system to be used (in 1977) for target irradiation in fusion research. SHIVA is also a development project in that it is pushing the state of the art in laser and optical technology. The present design calls for 20 parallel laser amplification chains whose

light output is pointed and focused at a small (100 mu) target within a chamber from semi-equally spaced three-dimensional directions. It is probable that SHIVA will be upgraded to as many as 42 chains in the next few years. Each chain of SHIVA contains 7 high energy laser amplifiers and perhaps 20 other major optical components, many of which send and receive control and measurement information. Again future expansion may add additional elements. Each chain has also associated 10 gimbal or translation motions for beam assignment from the oscillator onto the target. (auth)

7133 (UCRL-76985) MIRROR FUSION REACTOR STUDY. Carlson, G. A.; Moir, R. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Nov 1975. Contract W-7405-ENG-48. 46p. (CONF-751101-60). Dep. NTIS $5.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

The principal features of a fusion power reactor employing the magnetic mirror confinement concept are described. A parametric design and cost estimate analysis has been used to optimize the design for minimum capital cost per net electric output. Optimized parameters include the vacuum mirror ratio, the injection energy and angle, the choice of a thermal conversion cycle, and the design efficiency of the charged particle direct converter. The sensitivity of the cost of power for the optimized design to variations in many of the reactor parameters is discussed. (auth)

7134 (UCRL-77094(Rev.1)) LASER FUSION EXPERIMENTS AT THE LAWRENCE LIVERMORE LABORATORY. Ahlstrom, H. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Oct 1975. 95p. (CONF-751130-3). Dep. NTIS $6.00.

From ASP meeting; St. Petersburg, Florida, USA (10 Nov 1975).

A short review is given of some of the important dates in the experimental fusion program at Livermore. A few of the parameters of the laser systems which are being used for these experiments are mentioned. Some information about specialized diagnostics which have been developed at the Livermore Laboratory for these experiments is described. The focusing arrangements for each of the systems are discussed. Experiments both on planar targets and on targets for laser fusion are described. (auth)

7135 (UCRL-77105) IONIZATION, CHARGE EXCHANGE, AND SECONDARY ELECTRON EMISSION IN THE EXTRACTOR OF AN LBL/LLL NEUTRAL BEAM SOURCE. Fink, J. H.; McDowell, C. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Oct 1975. 7p. (CONF-751125-23). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Using a computer code, bombardment of the electrodes resulting from ionization, charge-exchange, and back-ion emission from the neutralizer cell is studied in the positive-ion extractor region of a Lawrence Berkeley Laboratory/Lawrence Livermore Laboratory (LBL/LLL) neutral beam source. Ion and electron trajectories are presented, grid dissipations estimated, and proposals made for future designs. (auth)

7136 (UCRL-77127) SELF-GENERATED MAGNETIC FIELDS IN LASER PLASMAS. Thomson, J. J.; Max, C. E.; Attwood, D. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Aug 1975. 7p. (CONF-751131-1). Dep. NTIS $4.50.

From 7th European conference on controlled fusion; Lausanne, Switzerland (1 Nov 1975).

Megagauss-level magnetic fields were predicted theoretically and observed experimentally. The field generation due to resonance absorption of laser light and thermoelectric currents is discussed. An experiment to measure these fields by Faraday rotation of light (2660A) is described. (auth)

7137 (UCRL-77153) DEPTH PROFILING OF TRITIUM BY NEUTRON TIME-OF-FLIGHT. Davis, J. C.; Anderson, J. D.; Lefevre, H. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1975. Contract W-7405-Eng-48. 19p. (CONF-751026-23). Dep. NTIS $4.50.

A method was developed to measure the depth profile of tritium implanted or absorbed in materials. The sample to be analyzed is bombarded with a pulsed proton beam and the energy of neutrons produced by the T(p,n) reaction is measured by the time-of-flight technique. From the neutron energy the depth in the target of the T atoms may be inferred. A sensitivity of 0.1 at. percent T or greater is possible. The technique is non-destructive and may be used with thick or radioactive host materials. Samples up to 20 mu m in thickness may be profiled with resolution limited by straggling of the proton beam for depths greater than 1 mu m. Deuterium depth profiling has been demonstrated using the D(d,n) reaction. The technique has been used to observe the behavior of an implantation spike of T produced by a 400 keV T^+ beam stopping at a depth of 3 mu m in 11 mu m thick layers of Ti and TiH. The presence of H in the Ti lattice is observed to inhibit the diffusion of T through the lattice. Effects of the total hydrogen concentration (H + T) being forced above stoichiometry at the implantation site are suggested by the shapes of the implantation spikes. (auth)

7138 (UCRL-77215) CONSTRUCTION AND TESTING OF THE 2XIIB FLAT-TOPPING POWER SUPPLY. Refigato, L. L.; Smith, B. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Nov 1975. Contract W-7405-Eng-48. 4p. (CONF-751125-20). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The construction details and test results of the 2XIIB flat-topping modules are described. Both practical design and construction considerations as well as fabrication techniques are discussed. Power for the main compression coils of the 2XIIB is derived by discharging a high-voltage capacitor bank and then crowbarring at the current peak to obtain L/R decay in the fields. To study plasma confinement under these quasi steady-state conditions, it is necessary to hold the compression-coil current constant for 10 ms. This is done by supplying only the I^2R losses of the system, using a low-voltage bank. The low-voltage bank consists of 48 modules each supplying 20,000 A at +-450 V to each compression coil for a total of 480,000 A. The low-voltage electrolytic bank is isolated from the high-voltage (20-kV) bank by silicon diodes, which also act as crowbars at the end of the 10-ms flat-topping or in the event that the electrolytic bank is not used. The 10-ms pulse is obtained by sequentially discharging ten electrolytic "drawers," each supplying a 1-ms pulse to each of the 48 modules. Each "drawer" consists of 24 1500-mu f electrolytic capacitors controlled by a thyristor and isolated from each other by rectifier diodes. Inductors are included as part of each drawer to limit the di/dt of the thyristor during the commutation process. (auth)

7139 (UCRL-77226) 2XIIB VACUUM VESSEL: A UNIQUE DESIGN. Hibbs, S. M.; Calderon, M. O. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Nov 1975. Contract W-7405-Eng-48. 6p (CONF-751125-29). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The 2XIIB mirror confinement experiment makes unique demands on its vacuum system. The confinement coil set encloses a cavity whose surface is comprised of both simple and compound curves. Within this cavity and at the core of the machine is the operating vacuum which is on the order of 10^{-9} Torr. The vacuum container fits inside the cavity, presenting an inside surface suitable for titanium getter pumping and a means of removing the heat load imposed by incandescent sublimator wires. In addition, the cavity is constructed of nonmagnetic and nonconducting materials (nonmetals) to avoid distortion of the pulsed confinement field. It is also isolated from mechanical shocks induced in the machine's main structure when the coils are pulsed. This paper describes the design, construction, and operation of the 2XIIB high-vacuum vessel that has been performing successfully since early 1974. (auth)

7140 (UCRL-77227) 1.1-METER BORE, 8-TESLA TEST FACILITY. Nelson, R.; Cornish, D.; Zbasnik, J.; Sackett, S.; Taylor, C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 Nov 1975. Contract W-7405-Eng-48. 6p. (CONF-751125-28). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The design and fabrication of a 1.1-m bore superconducting coil for an 8-T facility at Lawrence Livermore Laboratory are discussed. This facility will provide the backing field required for testing large multifilamentary Nb_3Sn coils as part of the superconductor development program at Livermore. The magnet measures 1.85 m o.d., is 1.5 m in length, and is solenoid wound in four separate modules. Total cold weight of the assembly is 18,000 Kg. A NbTi superconductor is used throughout with a gradation of current density within the magnet to provide complete cryostatic stability. The preliminary design of a large 3500-A multifilamentary Nb_3Sn insert magnet is also included. Together, the backing coil and insert magnets are designed to produce a 12-T central field in a 0.4m bore. The "equal area" theory of cryostatic stability is applied in the design of both magnet systems and is discussed in detail. A large open-mouth cryostat is used and measures 2 m in diameter and 3.7 m in length. Details of Dewar design and the refrigeration requirements are included. (auth)

7141 (UCRL-77233) PRELIMINARY CONCEPTUAL ENGINEERING DESIGN CONSIDERATIONS FOR THE MX MACHINE. Bulmer, R. H.; Calderon, M. U.; Hibbs, S. M.; Kozman,

T. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Oct 1975. 8p. (CONF-751125-2). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The mirror experiment was designed to develop the technologies necessary to make the transition from the presently small-scale physics experiments (2XIIB and BBII) to large-scale steady-state DT burning systems, such as the Fusion Engineering Research Facility (FERF) and Controlled Thermonuclear Reactors (CTR) based on plasma confinement in open magnetic geometry. The confinement parameters in the design of the present machine include a 20-kG central field with a mirror ratio of 2 to 1 and an overall BL product approximately 5 times greater than that currently available with the 2XIIB compression coils (or a mirror-to-mirror length of 3.4 m). Several types of Yin-Yang minimum parallel B parallel geometries were studied, and a "displaced" Yin-Yang was chosen because the center of the machine is easily accessable between the coils and between the magnet lobes. Other important design considerations include the target plasma system, the vacuum system, and the injectors. The target plasma system includes a pellet generating system used to produce a 400-mu m deuterium pellet and a two-arm laser system where the laser energy is produced from a 1-kJ, 10-GW CO_2 laser at 100 ns. (MOW)

7142 (UCRL-77234) NEUTRAL BEAM INJECTION IN 2XIIB. Hibbs, S. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Nov 1975. 6p. (CONF-751125-26). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Integrated into the operation of the 2XIIB controlled fusion experiment is a 600-A, 20-keV neutral injection system: the highest neutral-beam current capacity of any existing fusion machine. This paper outlines the requirements of the injection system and the design features to which they led. Both mechanical and electrical aspects are discussed. Also included is a brief description of some operational aspects of the system and some of the things we have learned along the way, as well as a short history of the most significant developments. (auth)

7143 (UCRL-77235) TESTS ON MULTIFILAMENTARY Nb_3Sn SUPERCONDUCTORS. Zbasnik, J.; Vandervoort, R.; Taylor, C.; Ping, D.; Hirzel, D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Nov 1975. Contract W-7405-Eng-48. 6p. (CONF-751125-18). Dep. NTIS $4.50.

Developmental work on multifilamentary Nb_3Sn superconductors produced by the bronze approach is described. Critical current vs field data for several types of conductors capable of carrying approximately 1000 A at 12 T are presented. Specimens with 1.4-mu m-diam filaments were very difficult to process and had relatively poor superconducting properties. Specimens with 2.4-mu m-diam filaments had good superconducting properties, and a degradation was observed if the samples were reacted too long. The 4.5-mu m-diam filament conductor had excellent superconducting properties, and the results indicate that a 2-day reaction at 650°C was sufficient to produce these properties. Preliminary versions of a scaled-up conductor had a very broad transition. (auth)

7144 (UCRL-77236) BEAM-LINE CRYOPUMP. Duffy, T. J.; Oddon, L. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Nov 1975. Contract W-7405-Eng-48. 5p. (CONF-751125-22). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A cryopumping module using metallic surfaces at liquid helium temperature for condensation of hydrogen and deuterium gas has been constructed. This pump, a prototype of four units which will provide pumping for the Livermore 200 kV test stand, will be used to verify the concept and establish engineering parameters. Upon completion of engineering tests and evaluation the pump will be installed in an operating beam line. The design point pumping capacity is 80,000 liters per second for hydrogen and deuterium at 10^{-4} torr based on sticking coefficients of 0.15 and 0.25, respectively. Both the liquid helium temperature pumping surface and the liquid nitrogen temperature radiation shields are constructed of quilted double wall cylindrical shells. The pumping shell dimensions are 1.5 meters dia. x 0.6 meters long. Cryogen circulation is convection current driven in both cases. Liquid helium is supplied from an overhead Dewar through bayonet coupling. In the 200 kV beam line, pumping modules will be supplied via transfer lines from a central Dewar. Voltage standoff will be accomplished in the transfer lines. (auth)

7145 (UCRL-77238) MECHANICAL DESIGN FOR NEUTRAL BEAM INJECTION. Pittenger, L. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Nov 1975. Contract W-7405-Eng-48. 6p. (CONF-751125-24). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

At the Lawrence Livermore and Berkeley Laboratories two major neutral beam system designs were developed, the High Voltage Test Stand (HVTS) and a conceptual system for the Two Component Tokamak-Toroidal Fusion Test Reactor (TCT-TFTR). The HVTS was designed for flexibility in performing a wide variety of tests, while the TCT-TFTR beam line was designed to satisfy particular requirements for target-plasma operation. Both designs make use of condensation cryopumping to handle very high gas loads. The HVTS design involves high-voltage isolation techniques of cryogenic and other systems. The TCT-TFTR design requires optimization of pumping and other systems. It is to be expected that experience gained from design and operation of the HVTS systems will be of value to the final design of TCT-TFTR and to the engineering of future fusion reactors. (auth)

7146 (UCRL-77239) PERFORMANCE ANALYSIS OF IN-LINE DIRECT CONVERTERS FOR NEUTRAL BEAM SOURCES. Bender, D. J.; Barr, W. L.; Moir, R. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Nov 1975. Contract W-7405-Eng-48. 8p. (CONF-751125-17). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The energetics of neutral beam formation from positive ion sources with beam direct conversion is presented. Two specific converters, the immersed grid and space charge controlled configurations, are described and their performance analyzed. The space charge controlled direct converter appears to be capable of high efficiency ion energy recovery at current density levels of interest in CTR applications. Experimental verification of the performance of this converter is underway. (auth)

7147 (UCRL-77241) EXPLOSIVE JOINTS IN Nb–Ti/Cu COMPOSITE SUPERCONDUCTORS. Cornish, D. N.; Zbasnik, J. P.; Pattee, H. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Nov 1975. Contract W-7405-Eng-48. 7p. (CONF-751125-25). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Explosive welding techniques have been applied to the joining of a Nb-Ti/Cu composite conductor. Details of the process are given together with mechanical and electrical evaluations of the resulting joints. (auth)

7148 (UCRL-77242) HIGH STABILITY SPACE FRAME FOR A LARGE FUSION LASER. Hurley, C. A.; Myall, J. O. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Nov 1975. Contract W-7405-Eng-48. 7p. (CONF-751125-9). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The Shiva laser system is a large neodymium glass laser target irradiation facility being constructed at LLL to perform laser fusion experiments. A frame is being constructed to support the large number of laser components that make up the Shiva system. Twenty laser chains composed of amplifiers, spatial filters, polarizers, rotators, and mirrors will be arranged in an optimum geometry so that each beam arrives at the target simultaneously and within alignment tolerances. This frame is capable of supporting approximately 600 individual component assemblies and maintaining a tolerance of +-4-mu rad rotation between any two points over a period of 100 s. Consideration has been given to the positional stability and support of the components, the geometrical array of stacked beams with respect to the oscillator and target, the flow of utilities (e.g., power cables and cooling gas pipes), good accessibility for operation and maintenance, and adaptability for change and growth. (auth)

7149 (UCRL-77243) LASER STARTUP OPTICS FOR BASEBALL II AND FUTURE MIRROR MACHINES. Frank, A. M.; Chargin, A. K.; Brown, N. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 Oct 1975. Contract W-7405-Eng-48. 9p. (CONF-751125-5). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The laser startup system for Baseball II-T uses a 300-J CO_2 laser to hit a 100-mu diameter pellet with a laser power density on the order of 10^{13} W/cm^2. The laser is a 20-cm diameter unstable resonator transversely excited (TEA) oscillator. The beam is split and then focused using off-axis parabolas. The symmetric configuration and central obscuration of the CO_2 beam allow coaxial alignment and pellet detection optics. This experiment

primarily uses commercially available systems and components. Optical elements were fabricated both by direct machining and standard polishing techniques. The laser and optical systems are directly scalable to reactor requirements using demonstrated technologies. (auth)

7150 (UCRL-77244) CALCULATION OF ELECTROMAGNETIC FIELDS AND FORCES IN COIL SYSTEMS OF ARBITRARY GEOMETRY. Sackett, S. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Nov 1975. Contract W-7405-Eng-48. 7p. (CONF-751125-11). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A computer program, EFFI, is described which calculates the electric and magnetic fields due to an arbitrary spatial distribution of current-carrying circular loops, circular arcs, and straight lines. The electric field is assumed to arise solely from the time variation of the magnetic field, and the magnetic field due to the changing electric field is assumed to be negligible. In addition, the conductor bundle elements (loops, arcs, lines) are assumed to be absent. Electric and magnetic flux lines and magnetic forces and inductances are also calculated by the program. The algorithm used in the code, which is based on a combination of direct and numerical integration using the Biot-Savart law, is discussed. The methods used to maintain accuracy in calculating fields within the conductor bundle, in particular, are detailed. Several examples are then presented to illustrate the input and output features as well as the accuracy obtained and the running time required. (auth)

7151 (UCRL-77248) ARGUS TARGET CHAMBER. Rienecker, F. Jr.; Glaros, S. S.; Kobierecki, M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Nov 1975. Contract W-7405-Eng-48. 7p. (CONF-751125-12). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A target chamber for application in the laser fusion program must satisfy some very basic requirements. (1) Provide a vacuum on the order of 10^{-6} torr. (2) Support a microscopically small target in a fixed point in space and verify its location within 5 micrometers. (3) Contain an adjustable beam focusing system capable of delivering a number of laser beams onto the target simultaneously, both in time and space. (4) Provide access for diagnostics to evaluate the results of target irradiation. (5) Have flexibility to allow changes in targets, focusing optics and number of beams. The ARGUS laser which is now under construction at LLL will have a target chamber which meets these requirements in a simple economic manner. The chamber and auxiliary equipment are described, with reference to two double beam focusing systems; namely, lenses and ellipsoidal mirrors. Provision is made for future operation with four beams, using ellipsoidal mirrors for two-sided illumination and lens systems for tetragonal and tetrahedral irradiation. (auth)

7152 (UCRL-77249) COMPOUND ELLIPSOIDAL FOCUSING SYSTEM FOR FUSION LASERS. Glaros, S. S.; Glass, A. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Nov 1975. 8p. (CONF-751125-10). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Isentropic compression of laser fusion targets requires highly uniform illumination over the entire target surface, and near normal incidence. For a two beam laser, this is best achieved using a fast catadioptric system. In designing such a system, the total thickness of refracting material must be minimized, to avoid loss of optical quality through small scale self focusing. Such a system is being fabricated for use with the ARGUS laser. It consists of a pair of nested ellipsoidal reflectors, coupled with an aspheric doublet refracting element which provides uniform illumination for the specified laser beam profile. (auth)

7153 (UCRL-77260) VIBRATIONAL, THERMAL, AND ALIGNMENT CONSIDERATIONS OF THE LASER SYSTEM FOR BASEBALL II-T. Thomas, S. R. Jr.; Chargin, A.; Denhoy, B.; Johnson, B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Nov 1975. Contract W-7405-Eng-48. 8p. (CONF-751125-1). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Designing the Baseball II-T laser system required addressing a number of mechanical parameters. Among them are low frequency floor vibrations, high acoustical noise levels, and large thermal fluctuations in the vicinity of the experiment. In addition, the 8-in. apertures from the 300-K environment of the laser system had to be compatible with the cryogenic environment of the superconducting Baseball magnet. This paper discusses these problems and describes their influence on the laser system design. (auth)

7154 (UCRL-77264) BASEBALL II-T, A NEW TARGET PLASMA STARTUP EXPERIMENT. Chargin, A.; Denhoy, B.; Frank, A.; Thomas, S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Nov 1975. Contract W-7405-Eng-48. 6p. (CONF-751125-19). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

A brief description is given of modifications and additions to the existing Baseball II experiment. These changes will make it possible to study target plasma buildup in a steady-state magnetic field. This experiment, now called Baseball II-T will use a pellet generator to deliver ammonia pellets into the center of the magnetic mirror field where they will be heated with a 300-J, 50-ns, CO_2 laser. The plasma created by this method will have a density of approximately 10^{13} cm^{-3} and a temperature of about 1 keV. This target plasma will be used for neutral beam injection startup studies with a 50-A, 20-keV neutral beam. Later, the beam power will be increased to study buildup. With ion injection energies of up to 50 keV, it may be possible to achieve eta tau as high as 10^{12} cm^{-3} s. The new components necessary to achieve these goals are described. (auth)

7155 (UCRL-77269) PROJECT PLANNING AND PROJECT MANAGEMENT OF BASEBALL II-T. Kozman, T. A.; Chargin, A. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Oct 1975. 6p. (CONF-751125-3). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The details of the project planning and project management work done on the Baseball II-T experiment are reviewed. The LLL Baseball program is a plasma confinement experiment accomplished with a superconducting magnet in the shape of a baseball seam. Both project planning and project management made use of the Critical Path Management (CPM) computer code. The computer code, input, and results from the project planning and project management runs, and the cost and effectiveness of this method of systems planning are discussed. (auth)

7156 (UCRL--77357(Rev.1)) DT FUSION NEUTRON RADIATION STRENGTHENING OF COPPER AND NIOBIUM. Mitchell, J. B.; Van Konynenburg, R. A.; Echer, C. J.; Parkin, D. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Oct 1975. 50p. (CONF-751026--32). Dep. NTIS $5.00.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (30 Sep 1975).

The initial results of a comparative study of the radiation strengthening and damage structures produced in Cu and Nb by D-T fusion and fission reactor neutrons are described. The radiation strengthening produced by a given fluence of fusion neutrons above about 10^{17} n/cm^2 is equal to that produced by a fluence of fission reactor neutrons (E greater than 0.1 MeV) ten times as great. This difference is about twice as large as would be expected if the strengthening scaled with damage energy or dpa. Initial transmission electron microscopy observations of the damage structures in fusion and fission reactor neutron irradiated copper indicate that the same type of primary structural defects, vacancy and interstitial point defect clusters and small dislocation loops with a/3 (111) and a/2 (110) Burgers vectors, are produced in both cases. The difference in the radiation strengthening produced by fusion and fission reactor neutrons in Cu appears to result from a substantially greater rate of accumulation of damage, in the form of point defect clusters, during irradiation with fusion neutrons than during irradiation with fission reactor neutrons plus a significant difference in the size and spatial distributions of the damage clusters. (auth)

7157 (UCRL-77456) PLASMA FOCUS AS A PULSED POWER SOURCE. Sahlin, H.; McFarland, G.; Bartlett, R.; Gullickson, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Nov 1975. Contract W-7405-Eng-48. 33p. (CONF-751108-16). Dep. NTIS $5.00.

From 1st international topical conference on electron beam research and technology; Albuquerque, New Mexico, USA (3 Nov 1975).

The plasma focus is a remarkable natural phenomena that achieves significant space-time compression of both particle and field energy. Depending on the mode of operation, about 20 percent of the bank energy can be concentrated into the kinetic energy of a thin, dense, cylindrically convergent gas shell, or into a small-diameter, high-nu/gamma relativistic electron burst and oppositely directed ion burst. The kinetic energy of the fast ions and electrons can exceed the applied voltage by a factor of greater than 100. The different modes of energy concentration by the plasma

focus are presented and discussed both in terms of their role in the direct yield of the focus and for the case of a plasma focus supplemented by various fusionable targets. (auth)

7158 (UCRL-77499) ENERGY STORAGE AND POWER CONDITIONING SYSTEM FOR THE SHIVA LASER. Allen, G. R.; Gagnon, W. L.; Rupert, P. R.; Trenholme, J. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Nov 1975. Contract W-7405-Eng-48. 6p. (CONF-751125-4). Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

An optimal energy delivery system for the world's largest glass laser system has been designed based on computer modeling and operation of laser hardware. Components of the system have been tested on operating lasers at LLL. The Shiva system is now under construction and will be completed in 1977. The energy supply described here will provide cost-effective, reliable power and facilitate the gathering of data in pursuit of controlled thermonuclear reactions. (auth)

7159 FIRST RESULTS ON T. F. R. pp 20-36 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

A brief description of the TFR tokamak is given. The first results obtained since the start of the experiment (March 1973) are presented. The maximum values of the current and the toroidal field were 200 A and 40 kG. (MOW)

7160 REVIEW OF SCYLLAC θ-PINCH EXPERIMENTS. Quinn, W. E.; Ellis, W. R.; Gribble, R. F.; Harder, C. R.; Kristal, R.; Ribe, F. L.; Sawyer, G. A.; Siemon, R. E.; Thomas, K. S. (Los Alamos Scientific Lab., NM). pp 93-108 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

Scyllac research on 5-m and 8-m toroidal sectors, and the 5-m linear θ pinch are discussed. In addition, the plans for the full Scyllac torus, feedback stabilization, and a staged θ pinch are described. (MOW)

7161 PULSED FUSION OF PELLETS USING ELECTRON BEAMS OR LASERS. Beckner, E. H.; Freeman, J. R.; Gerardo, J. B.; Jones, E. D.; Toepfer, A. J.; Yonas, G. (Sandia Labs., Albuquerque, NM). pp 200-226 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

The physical and technological concepts and barriers which are important for pulsed fusion of pellets using relativistic electron beams or lasers are discussed. Recent numerical calculations of pellet dynamics are given for the two cases in order to illustrate the similarities that exist and to indicate the significant differences which can be utilized in the spatial and temporal scale of the implosions. These calculations specify the experimental parameter regime which must be achieved, with input energy ranging as low as a few hundred kilojoules in the case of electron beams and a few kilojoules in the case of lasers; power densities in the two cases tend to be comparable. An assessment of current technology, including some new results for electron beam pumped lasers, is then made for comparison. The remaining physical problems and the solutions required for achievement of fusion break-even experiments are discussed. (auth)

7162 SUPER-HIGH DENSITY LASER FUSION CTR. Thiesen, A.; Zimmerman, G.; Weaver, T.; Emmett, J.; Nuckolls, J.; Wood, L. (Univ. of California, Livermore). pp 227-258 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

The basic concepts involved in laser fusion for power generation are reviewed. Brief discussions are given for each of the following topics: (1) implosion development and application, (2) thermonuclear physics, (3) implosion physics, (4) laser technology, (5) laser CTR reactors, and (6) fusion energy conversion. (MOW)

7163 THEORY AND EXPERIMENT IN LASER DRIVEN FUSION. Brueckner, K. A. pp 259-284 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

A review of research at KMS fusion is presented. Some computer simulations of the implosion process are mentioned. Absorption and reflectivity measurements are described. (MOW)

7164 ENGINEERING PROBLEMS IN CTR. Carruthers, R. (Culham Lab., Abingdon, Eng.). pp 306-318 of Sixth European Conference on Controlled Fusion and Plasma Physics. Vol. II. Dubna, USSR; Joint Inst. for Nuclear Research (1974).

From 6th European conference on controlled fusion and plasma physics; Moscow, USSR (30 Jul 1973). See CONF-730705-P2.

Some of the engineering requirements for a fusion reactor are discussed. Some reactor problems involving the interior, exterior, and the interface regions are described. (MOW)

7165 OPTICALLY GATED DYE CELL: A HIGH-SPEED SHUTTER AND PULSE SHAPER. Massey, G. A.; Elliott, R. A. (Oregon Graduate Center, Beaverton). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 358-364 (Jul 1975).

This paper discusses characteristics of a class of devices that use a saturable absorber irradiated by an optical control pulse, or gating pulse, to alter the shape of a transmitted optical signal. Two device geometries were considered; a longitudinally gated cell, in which signal and gate beams are nearly parallel, and a transverse cell, in which the medium is bleached by a gating pulse applied at right angles to the signal beam. The longitudinal device permits synthesis of rising exponential signal pulses with arbitrary, submanosecond time constants. The transverse geometry can provide pulses of complex shape and permits independent optimization of several device parameters. The dynamics of the saturable absorber (with particular emphasis on liquid dye systems) is analyzed in detail, and a pulse-shape synthesis procedure is outlined. Spurious nonlinear effects are considered, and an example of pulse shaping for laser-driven fusion is given. (auth)

Wave Phenomena

7166 (FUPH-R-123) FINITE AMPLITUDE EFFECTS IN THE PROPAGATION AND INTERACTION OF m = 0 TORSIONAL HYDROMAGNETIC WAVES. Jones, I. R.; Cheetham, A. D. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). Jul 1975. 28p. Dep. NTIS (US Sales Only) $5.00.

The nonlinear behavior of the m = 0 torsional hydromagnetic wave is analysed. Two cases were considered: the nonlinear self-interaction of a single torsional wave and the nonlinear interaction of two identical, oppositely propagating torsional waves. In the first case the nonlinear terms in Ohm's law and the equation of motion generate a second order perturbation which accompanies the primary wave and has two components: a steady component and an oscillatory component having twice the frequency of the primary torsional wave. In the second case studied the self- and cross-interactions of the two waves again generate a second order perturbation field. The existence of certain critical wavelengths, at which geometric resonances of the perturbation occur, is established. (auth)

7167 (FUPH-R-126) SIMPLIFIED THEORY FOR TONKS–DATTNER RESONANCES IN CYLINDRICAL PLASMAS. How, J. A.; Blevin, H. A. (Flinders Univ. of South Australia, Bedford Park. School of Physical Sciences). Sep 1975. 20p. Dep. NTIS (US Sales Only) $4.50.

A simple analytic solution for Tonks–Dattner resonances in a cylindrical plasma with a parabolic density profile is derived using the approximation of pure electrostatic radial waves. For other density distributions the resonances are calculated using numerical integration of a second order differential equation. Results are compared with the scalar pressure theory as derived by Parker, Nickel and Gould (1964), and with Dattner's experimental results (1963). Excellent agreement is obtained over the full range of conditions used in these publications. (auth)

7168 (IPP-6/136) STRONG TURBULENCE THEORY AND THE TRANSITION FROM LANDAU TO COLLISIONAL DAMPING. Dum, C. T. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jun 1975. 8p. INIS.

2 figs.; 11 refs.

New methods are introduced for a quantitative evaluation of the dielectric constant describing the interaction of a long wavelength test wave with electrons in the presence of electron-ion collisions or small scale turbulence. It is shown that the usual resonance broadening arguments of strong turbulence theory do not apply. (auth)

7169 (N-74-18363) NONLINEAR WAVE PROPAGATION IN PLASMAS PROPAGATION. Delcroix, J. L.; Bretagne, J.; Leprince, P. Mantei, T. D.; Mathieussent, G. (Paris-11 Univ., 91-Orsay (France). Lab. de Physique des Plasmas). Sep 1972. 51p. (LP-141). NTIS $5.75.

Wave propagation in plasmas is well understood in the linear approximation, both from the theoretical and experimental point of view, but the nonlinear processes affecting wave propagation are less well known. Recent progress in this field is outlined including a comparison of experimental results with theoretical predictions of wave-wave coupling and decay, particle trapping by a large-amplitude wave, and the formation of solitons and shock waves. (auth)

7170 NONLINEAR SYSTEM OF EULER-LAGRANGE EQUATIONS. Reduction to the Korteweg-de Vries Equation and Periodic Solutions. Zielke, W. (Inst. of Fundamental Technological Research, Warsaw). J. Math. Phys. (N. Y.); 16: No. 8, 1573-1579 (Aug 1975).

The Euler-Lagrange equations, which correspond to a variational principle with a Lagrange function depending on arbitrary functions and their first order derivatives, are shown to be reducible to the Korteweg-de Vries equation under a small--but finite--amplitude approximation. Closed form periodic solutions to the Euler-Lagrange equations are found for a particular case, and the modulational stability of these solutions is discussed. Equations for waves in cold plasma are discussed as examples. (auth)

ENGINEERING

7171 (AECL-5035, pp 25-27) APPLICATIONS OF ELECTRONIC AIDS IN ENGINEERING DESIGN. Shah, R. R.; Yan, G. (Chalk River Nuclear Labs., Ont.). Win 1975.

In AECL research and development in engineering. (Atomic Energy of Canada Ltd., Chalk River, Ontario).

A mundane but important aspect of engineering is arrangement of components and connections among them. Modern electronics enables one to use computers as sketch pads. When sketching is complete, drawings are plotted and stored on cassette tapes. Revisions can be made at any time and rapid updating is a feature. Use of the system in the design of various electronic circuits is described. (TFD)

Energy Conversion

Refer also to abstracts 7407–7409.

Facilities and Equipment

Refer also to abstracts 7171 and 7931.

7172 (IKE-3-5D) MEASUREMENT OF THE POWER DENSITY DISTRIBUTION OF A MONOENERGETIC ELECTRON BEAM AND INVESTIGATION OF ITS EFFECTS ON THE WELDING SEAMS IN ELECTRON BEAM WELDING. Sioe Yao Kan. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Nov 1974. 94p. (In German). INIS.

34 figs.; 21 refs.

The radial power density distribution as well as the cross section were investigated in dependence on the beam parameters such as beam current, acceleration voltage, working distance and focussing, in the beam of a 15 kW electron beam welding equipment. A measuring method and apparatus were developed for this. This apparatus also allows the focussing of the electron beam. A computer program was set up to evaluate the measured results and to calculate the radial power density distribution. The welding seam formation was compared with the calculated power density distribution using polished samples. (auth)

7173 (PEM-45) CABLE AND CONNECTOR SHIELDING ATTENUATION AND TRANSFER IMPEDANCE MEASUREMENTS USING QUADRAXIAL AND QUINTAXIAL TEST METHODS. Madle, P. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Nov 1975. 23p. Dep. NTIS $4.50.

The relations between the shielding attenuation, the transfer impedance and the shielding effectiveness of an assembly of shielded cables and connectors are discussed. Six possible shielding attenuation test methods, i.e., open wire, coaxial, inverted triaxial, quadraxial, and quintaxial, are described and their advantages, disadvantages and limitations are discussed. The use of the quintaxial test method is illustrated by a limited amount of test data obtained on several types of standard coaxial cable. The samples tested were of approximately 75 cm length and ranged from approximately 0.2 cm to 0.5 cm in dia. The frequency range of the tests extended from 0.1 MHz to 3,000 MHz. (auth)

7174 (UCRL-51933) LLL TRANSIENT-ELECTROMAGNETICS-MEASUREMENT FACILITY. Deadrick, F. J.; Miller, E. K.; Hudson, H. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Oct 1975. Contract W-7405-Eng-48. 32p. Dep. NTIS $4.00.

The operation and hardware of the Lawrence Livermore Laboratory's transient-electromagnetics (EM)-measurement facility are described. The transient-EM range is useful for determining the time-domain transient responses of structures to incident EM pulses. To illustrate the accuracy and utility of the EM-measurement facility, actual experimental measurements are compared to numerically computed values. (auth)

7175 VIBRATIONS OF A ROW OF CIRCULAR CYLINDERS IN A LIQUID. Chen, S. S. (Argonne National Lab., IL). J. Eng. Ind.; 97: No. 4, 1212-1218(Nov 1975).

From American Society of Mechanical Engineers technical conference; Washington, DC, USA (17 Sep 1975).

The effects of interaction with surrounding liquid on the dynamic behavior of a row of circular cylinders were studied analytically. The hydrodynamic forces associated with cylinder motions were obtained using the potential flow theory and a method of solution is presented for free and forced vibrations of a row of cylinders. The results of this study have important application in the modeling of crossflow-induced vibration of heat-exchanger tubes. (auth)

Lasers

Refer also to abstracts 7165 and 8797.

7176 (IPP-IV-83) SINGLE LONGITUDINAL MODE OPERATION OF PULSED CO_2 LASERS. Heckenberg, N. R. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Jul 1975. 33p. Dep. NTIS (US Sales Only) $5.00.

A number of experiments are described which were carried out as part of a program to develop a high power pulsed CO_2 laser operating on a single transverse and longitudinal mode. (auth)

7177 (IPP-IV-84) CONSTRUCTION AND STUDY OF CO_2 LASER AMPLIFIERS WITH SELF-SUSTAINED AND NON-SELF-SUSTAINED GAS DISCHARGE. Schmid, W. E. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Aug 1975. 131p. (In German). Dep. NTIS (US Sales Only) $7.00.

The two most important techniques to pump high pressure CO_2-lasers are the selfsustained and the electron beam controlled discharge. Amplifiers of these two kinds have been built and the performance for CO_2 high power lasers has been investigated theoretically and experimentally. The experimental results show that the less complicated method of selfsustained discharge is suitable for laser oscillators. For laser amplifiers pumping by electron beam controlled discharge is to be preferred. A numerical model that takes account of the rotational relaxation processes during pulse duration has been developed. This model allows the prediction of the shape and energy of laser pulses produced by a CO_2 oscillator-amplifier system. (auth)

7178 (SAND-75-0492) LASER FEEDBACK CALCULATIONS. Brannon, P. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1975. Contract AT(29-1)-789. 10p. Dep. NTIS $4.00.

A straightforward analysis of the frequency effects of laser light reflected back into the laser is given. A simple three-mirror system is analyzed, but the method can be applied to any complex mirror system. (auth)

7179 (UCID-16960) FARADAY ROTATOR 5 kV CAPACITOR BANK. Fetterman, C. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Nov 1975. Contract W-7405-eng-48. 25p. Dep. NTIS $4.00.

A Faraday rotator 5 kV capacitor bank is a pulsed output power supply used to energize Faraday rotators for optical isolation in the "LLL kJ Glass Laser System." Each supply contains either one, two or three parallel 240 mu F storage capacitors depending on the size of the isolator used. Generally, the "A*"(216 mu H) isolator is energized with one capacitor, the "A"(116 mu H) isolator uses two capacitors and the "B"(87 mu H) isolator requires three capacitors. All models of isolators have been tested with four capacitors under maximum voltage and 25 feet of RG-217 cable with no hazardous effects. Except for the number of capacitors in each unit, the supplies are otherwise physically identical. (TFD)

7180 (UCRL-76958) OXYGEN AURORAL TRANSITION LASER SYSTEM EXCITED BY COLLISIONAL AND PHOTOLYTIC ENERGY TRANSFER. Murray, J. R.; Powell, H. T.; Rhodes, C. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Jun 1975. 11p. (CONF-7506103-1). Dep. NTIS $4.50.

From conference on laser spectroscopy; Megeve, France (23 Jun 1975).

The properties of laser media involving the auroral transition of atomic oxygen and analogous systems are examined. A discussion of the atomic properties, collisional mechanisms, excitation processes, and collisionally induced radiative phenomena is given. Crossing phenomena play a particularly important role in governing the dynamics of the medium. (auth)

7181 COMPUTER MODEL FOR THE H2 + F2 SUPERRADIANT LASER. Moreno, J. B. (Sandia Labs., Albuquerque, NM). vp of Thirteenth aerospace sciences meeting. New York; American Inst. of Aeronautics and Astronautics (1975).

From 13th aerospace sciences meeting; Pasadena, CA, USA (20 Jan 1975).

A computer model has been developed to investigate the H2 + F2 superradiant laser. The model is a complex system of space- and time-dependent partial differential equations, governing the coupled chemistry and radiation. Rotational nonequilibrium is allowed. Numerical solutions are obtained using an implicit method-of-characteristics technique. The resulting computer code has moderate storage and time requirements despite the size of the problem. Operation of the H2 + F2 laser, both super-

radiantly and driven by a cw oscillator, has been studied. Results are presented showing the effects of gas mixture, initiation, incident radiation, geometry, and kinetic rates. (auth)

7182 MIXED METAL VAPOR PHASE MATCHING FOR THIRD-HARMONIC GENERATION. Bloom, D. M.; Young, J. F.; Harris, S. E. (Stanford Univ., CA). Appl. Phys. Lett.; 27: No. 7, 390-392(1 Oct 1975).

Phase matching for frequency tripling of 1.06 mu m is demonstrated in a homogeneous mixture of sodium and magnesium vapor. The ratio of Mg to Na vapor pressures required for phase matching is 2:1. This ratio is about 1/15 of that required to phase match Na with Xe. (auth)

7183 cw OPERATION OF DISTRIBUTED-FEEDBACK GaAs-GaAlAs DIODE LASERS AT TEMPERATURES UP TO 300 K. Nakamura, M. (Hitachi Ltd., Tokyo); Aiki, K.; Umeda, J.; Yariv, A. Appl. Phys. Lett.; 27: No. 7, 403-405(1 Oct 1975).

Distributed-feedback GaAs-GaAlAs diode lasers with separate optical and carrier confinement have been successfully operated under dc bias up to room temperature. They lased in a single longitudinal mode with a threshold current density of 0.94 kA/cm^2 at 170^{0}K and 3.5 kA/cm^2 at 300^{0}K. (auth)

7184 HIGH-POWER XENON FLUORIDE LASER. Ault, E. R.; Bradford, R. S. Jr.; Bhaumik, M. L. (Northrop Research and Tech. Center, Hawthorne, CA). Appl. Phys. Lett.; 27: No. 7, 413-415(1 Oct 1975).

High-power laser emission has been observed from xenon fluoride (XeF) at 351.1 and 353.1 nm. A peak laser power of 0.5 MW was obtained by using a mixture of Ar, Xe, and NF_3 in the ratio of 250:25:1 at a total pressure of 1.7 atm. The laser gas was excited by a 1-MeV 20-kA electron beam for a pulse duration of 20 nsec. Energy deposited in the gas by the electron beam was estimated to be 1 J which gives a laser efficiency of 0.5 percent. Using a coaxial electron gun, an 80-mJ 100-nsec pulse was obtained with an efficiency of 3 percent. (auth)

7185 SEMICONDUCTOR LASER RADIATION IN STRONG MAGNETIC FIELDS AND AT HIGH HYDROSTATIC PRESSURES. Zasavitskii, I. I. pp 3-73 of Optical Properties of Semiconductors. Moscow; Izdatel'stvo Nauka (1974). (In Russian)

The results of experimental studies concerning the effect of a magnetic field on the emission spectra of InAs, InSb, and PbSe injection lasers and the effect of high pressure on radiation frequency tuning characteristics of GaAs and PbSe lasers are analyzed. Magnetically tunable stimulated Raman scattering was obtained in n-type InSb crystals with inelastic scattering of light at 10.6 microns wavelength with excitation of electrons from the lower Landau spin sublevel to the upper. Carrier effective masses and g-factors were determined, and the dependence of forbidden zone width and index of refraction on pressure and the magnetic field was obtained. (IAA)

7186 METHOD TO MEASURE PULSED INFRARED LASER SPECTRA BY MEANS OF HOLOGRAPHY. Braun, W. (Max-Planck-Institut fuer Plasmaphysik, Munich). Opt. Eng.; 14: No. 3, 208-209(1975).

A holographic method for the measurement of pulsed infrared laser spectra is reported. The first application was the measurement of the pressure dependent emission spectrum of a pulsed HF-laser (10 Joules, 150 ns). (auth)

7187 INTEGRATED GaAs-Al/sub x/Ga/sub 1-x/ AS DOUBLE-HETEROSTRUCTURE LASER WITH INDEPENDENTLY CONTROLLED OPTICAL OUTPUT DIVERGENCE. Logan, R. A.; Reinhart, F. K. (Bell Labs., Murray Hill, NJ). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 461-464(Jul 1975.

Liquid-phase-epitaxial growth procedures have been used to form a double-heterostructure (DH) laser in which the radiation is taper coupled from the active layer into a passive waveguide. The taper extends smoothly over distances approximately 100 mu m and efficiently couples the radiation from the electrically pumped section into a low-loss adjacent waveguide of comparable dimension (0.5 mu m). The passive-waveguide dimension beyond the taper coupler is widened to any desired dimension by inserting a cooling fin (or spacer) into the growth melt, permitting control of the laser output divergence without mode conversion. These structures have been made with the following properties: threshold current density 2.6 kA/cm^2; differential quantum efficiency 28 percent; taper coupling efficiency approximately 90 percent; and half-power radiation field angles of 48 and 29^0 from the active (0.5 mu m thick) and passive (1.5 mu m thick) regions, respectively. Using similar growth procedures, devices have been constructed where the laser radiation is taper coupled into passive waveguides permitting both laser mirrors to be formed in passive regions. (auth)

7188 LASER DIAGNOSTICS USING LIGHT INTENSITY MEASUREMENTS FOR CONTINUOUSLY EMITTING ACTIVE MEDIA. Blanaru, D. L. (Univ. of Texas, Dallas). J. Appl. Phys.; 46: No. 7, 3024-3031(Jul 1975).

The intensity of light extracted from an optical cavity is a sensitive function of the peak absorption coefficient, k_0, and can be used to survey the evolution of k_0 when the parameters of the active medium are changed during the process of laser development. This provides a means for identifying the spectral lines which may be suitable for lasing transitions and an indication of how to optimize k_0 when it is still below the laser threshold. The theoretical dependence of the measured intensity on k_0 is derived for continuously emitting media, arbitrary optically stable cavity configurations, and symmetric or asymmetric line profiles. The calculations show that the light intensity at an axial point is produced by those light sources which are confined in certain emission volumes within the active medium determined by the diaphragming conditions of the measuring system. Two basic measurement modes were identified according to whether the emission volumes are controlled (a) by the mirror apertures or (b) by an adjustable external diaphragm. The latter measuring mode is independent of all cavity geometrical parameters, and the experimental test which confirmed this conclusion indicates that the absolute error in the measurement of k_0d, where d is the active medium length, is 0.015 for small absorptions and for cavity losses lower than 12 percent per round trip. (auth)

7189 EFFICIENT AND PRACTICAL HYDROGEN VACUUM ULTRAVIOLET LASER. Knyazev, I. N.; Letokhov, V. S.; Movshev, V. G. (Inst. of Spectroscopy, Moscow). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 10, 805-817(Oct 1975).

Investigations of the hydrogen vacuum ultraviolet (VUV) laser carried out in the Institute of Spectroscopy of the USSR Academy of Sciences are reviewed. Data for VUV TEA H_2 and D_2 lasers at gas pressure up to 2 atm and for low-pressure high-repetition rate hydrogen lasers are presented. The upper limit quantum system efficiency for both gas discharge and e-beam excitation of H_2 lasers is discussed. The possibility of obtaining cw operation of the H_2-VUV laser is also discussed. (auth)

7190 MASS SPECTROSCOPY OF THE HCN-LASER PLASMA. Schoetzau, H. J.; Kneubuehl, F. (Swiss Federal Inst. of Tech., Zurich). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 10, 817-821(Oct 1975).

The chemical composition of the HCN-laser discharge plasma was measured. The results show the important role of hydrogen in the HCN laser. Additional experiments with different gas mixtures prove that hydrogen molecules are necessary for population inversion in the HCN laser. (auth)

7191 ULTRAVIOLET ION LASER PERFORMANCE AND SPECTROSCOPY. I. New Strong Noble-Gas Transitions Below 2500 A. Marling, J. B. (Univ. of California, Livermore). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 10, 822-838(Oct 1975).

The performance and spectroscopy of UV ion lasers have been investigated to 1850 A, the limit of available mirrors. New anomalously strong transitions of about 1-kW peak power were found in Xe IV, at 2315.357 A and Kr IV at 2191.916 A. The shortest wavelength new laser transition was Kr IV at 1949.623 A. Wavelengths were measured for 25 new and many previously known UV laser transitions to about 0.006 A. Optimum output in watts was also measured as a function of bore current density and gas pressure. All measurements were taken from a 7-mm-bore 150-cm-arc-length tube designed for low electrical inductance providing current excitation pulses with 250-ns full width at half maximum (FWHM). (auth)

7192 FAR INFRARED FREQUENCY SYNTHESIS WITH STABILIZED CO_2 LASERS: ACCURATE MEASUREMENTS OF THE WATER VAPOR AND METHYL ALCOHOL LASER FREQUENCIES. Petersen, F. R. (National Bureau of Standards, Boulder, CO); Evenson, K. M.; Jennings, D. A.; Wells, J. S.; Goto, K.; Jiminez, J. J. IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 10, 838-843(Oct 1975).

A far infrared (FIR) frequency synthesis technique using saturated-absorption stabilized CO_2 lasers and a point-contact diode has been used to measure frequencies of a number of strong cw H_2O, D_2O, and CH_3OH laser lines. The first frequency measurements of the 79-mu m H_2O, the 73- and 108-mu m D_2O, and 11 CO_2-pumped cw $^{12}CH_3{}^{16}OH$ laser lines are reported. This measurement is the first demonstration of the general usefulness of CO_2 lasers for accurate synthesis of FIR frequencies. (auth)

7193 TIME-RESOLVED OUTPUT SPECTRUM FROM A HYDROGEN FLUORIDE LASER USING MIXTURES OF SF_6 AND HI. Greiner, N. R. (Los Alamos Scientific Lab., NM). IEEE

(Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 10, 844-845(Oct 1975).

The time-resolved spectrum from a transverse-discharge hydrogen fluoride (HF) laser using a mixture of SF_6 and HI is reported. Because this spectrum matches that from a high-pressure H_2-F_2 laser, and because the SF_6-HI mixture is chemically stable, this laser should be a suitable and convenient source for probing H_2-F_2 amplifiers. (auth)

7194 CONTINUOUS OSCILLATION OF A LITHIUM NEODYMIUM TETRAPHOSPHATE LASER WITH 200-mu W PUMP THRESHOLD. Otsuka, K.; Yamada, T. (Telegraph and Telephone Public Corp., Musashino-shi, Japan). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 10, 845-846 (Oct 1975).

Room temperature cw oscillation of a lithium neodymium tetraphosphate ($LiNdP_4O_{12}$) (LNP) laser with thresholds in the fractional milliwatt range is reported. With a 5145-A pump, observed threshold was 200 mu W and the slope efficiency was 43 percent. (auth)

7195 INDUCED-EMISSION CROSS SECTIONS FOR THE ^{4}F/sub 3/2/ yields ^{4}I/sub 13/2/ TRANSITION IN NEODYMIUM LASER GLASSES. Jacobs, R. R.; Weber, M. J. (Univ. of California, Livermore). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 10, 846-847(Oct 1975).

Induced-emission cross sections for the ^{4}F/sub 3/2/ yields ^{4}I/sub 13/2/ transition of Nd^{3+} in several commercial and experimental laser glasses have been determined using spectroscopic data and the Judd-Ofelt treatment of electric-dipole transition probabilities. (auth)

7196 PERFORMANCE OF A COMPACT SEALED 2000-W CO_2 LASER. Fahlen, T. S. (Electro-Optics Organization, Mountain View, CA.). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 10, 848-849(Oct 1975).

The performance characteristics of a compact (3-ft^3) TEM_{00}-mode single-wavelength CO_2 laser are described. The optic axis, gas flow velocity, and glow discharge are mutually orthogonal in the sealed-off laser head. The laser produces up to 300 W of TEM_{00}-mode 10.6-mu m power. (auth)

7197 NEW VISIBLE LASER TRANSITIONS IN Ba I AND Ba II. Baron, K. U.; Stadler, B. (Univ., Heidelberg). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 10, 852-853(Oct 1975).

Three new visible laser transitions at lambda equals 7120 A in Ba I and at lambda equals 6496.9 and 6141.7 A in Ba II have been observed in a pulsed discharge with Xe, Ne, and He as carrier gas. A new all-metal hollow-cathode design was used. (auth)

7198 NEW FAR-INFRARED LASER LINES FROM CO_2-LASER PUMPED CH_3OH GAS BY USING A COPPER WAVEGUIDE CAVITY. Tanaka, A.; Yamanaka, M.; Yoshinaga, H. IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 10, 853-854(Oct 1975).

Eleven new far-infrared (FIR) laser lines have been observed from CH_3OH pumped by a CO_2 laser. These lines are ranged from 78 to 694 mu m and are obtained by using a copper waveguide cavity. (auth)

7199 LEAD-TIN TELLURIDE DOUBLE-HETEROJUNCTION LASER DIODES: THEORY AND EXPERIMENT. Tomasetta, L. R.; Fonstad, C. G. (Massachusetts Inst. of Tech., Cambridge). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 384-390(Jul 1975).

Calculations of threshold current densities for lead-tin telluride double-heterojunction (DH) laser diodes are presented, in which the spatial distribution of the injected minority carriers and the critical level of minority carrier injection necessary for population inversion are considered. Excellent agreement between the predictions of this model and experimental data is obtained, which suggests that credible predictions of high-temperature performance can be made. The need to inject a critical level of minority carriers is shown to be the principal contribution to the threshold current density except at very low temperature and to lead to a rapid increase in threshold with increasing temperature. It is found experimentally that below 40 K the threshold no longer decreases with temperature; two possible explanations for this behavior are suggested. (auth)

7200 SELECTION OF MODES PERPENDICULAR TO THE JUNCTION PLANE IN GaAs LARGE-CAVITY DOUBLE-HETEROSTRUCTURE LASERS. Krupka, D. C. (Bell Labs., Murray Hill, NJ). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 390-400(Jul 1975).

The gains and reflectivities of the transverse-electric (TE) modes of GaAs large-cavity double-heterostructure (DH) (P-p-n'-N) lasers have been calculated in order to study mode selection perpendicular to the junction plane. The GaAs laser is modeled as a passive dielectric-slab waveguide composed of four layers whose optical constants are taken from recent literature. In lasers having a cavity thickness of a few microns, a small difference in refractive index between the p- and n'-region leads to the fundamental mode being confined to the p-region. Discrimination in favor of this mode without significant penalty in threshold gain may be achieved by utilizing the mode-dependent loss in the n'-layer. It is found that optimum mode discrimination in favor of the fundamental mode is governed by a suitable combination of the p-layer thickness, loss in the n'-region, and the difference of refractive indices of the p- and n'-layers. This analysis contrasts with an earlier analysis of the case of uniform refractive index in which it was found that the p-layer should be twice as thick as the n-layer for optimum mode discrimination. The calculated mode shapes in P-p-n'-N lasers are found to be in qualitative agreement with those observed recently by Hakki, and also with earlier observations that catastrophic mirror damage in P-p-n'-N lasers is confined to the p-region. Contrary to experimental observation, the model predicts that lasers having cavity thicknesses as large as 3 mu m should operate stably in the fundamental mode. Possible reasons for this discrepancy are advanced. A simplification of the P-p-n'-N laser, which consists of omitting the N-layer thus yielding an asymmetric double-heterostructure laser, is suggested, and the merits and drawbacks of such a design are discussed. (auth)

7201 ANGULAR BEAM DIVERGENCE IN DOUBLE-HETERO-JUNCTION LASERS WITH VERY THIN ACTIVE REGIONS. Dumke, W. P. (IBM Thomas J. Watson Research Center, Yorktown Heights, NY). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 400-402(Jul 1975).

An analytical expression is found for the angular beam divergence from a double-heterojunction (DH) laser in the limit of an infinitely thin active region. In this limit the beam divergence is proportional to the thickness of the active region and to the index of refraction difference between the active and confining layers. A simple expression combining the limiting expressions for thin and thick active regions gives a very accurate fit to the numerical calculations of the beam divergence for intermediate active region thicknesses. (auth)

7202 INTERNAL OPTICAL LOSSES IN VERY THIN CW HETEROJUNCTION LASER DIODES. Butler, J. K.; Kressel, H.; Ladany, I. (Office of Naval Research, Arlington, VA). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 402-408(Jul 1975).

Theoretical calculations are presented showing the relationship between the internal laser absorption and structural parameters appropriate for cw room-temperature lasers. These diodes have submicron-thick recombination regions, and very small spacings between the heat sink and the recombination region to minimize the thermal resistance. The optical loss is shown to be strongly dependent on the degree of radiation confinement to the active region. In particular, absorption in the surface GaAs layer providing the ohmic contact becomes very significant when the intermediate (AlGa)As layer is reduced below about 1 mu m. It is further shown that excessive penetration into the GaAs regions gives rise to anomalies in the far-field radiation profiles in the direction perpendicular to the junction plane. Proper design of the internal structure of the laser avoids large increases of the threshold current density as well as large decreases in the external differential quantum efficiency from interaction with the contact layer. The design curves presented can be used to predict the gain required at threshold for a broad range of structural parameters of interest in low-threshold laser design. (auth)

7203 CALCULATIONS OF THE CONTINUOUS-WAVE LASING RANGE AND LIGHT-OUTPUT POWER FOR DOUBLE-HETEROSTRUCTURE LASERS. Garel-Jones, P.; Dyment, J. C. (Bell-Northern Research, Ottawa). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 408-413(Jul 1975).

Procedures for calculating the range of currents and heat-sink temperatures in which continuous-wave (cw) operation is possible and the light-output power levels within this range are presented for double-heterostructure lasers with an oxide-insulated stripe geometry. A one-dimensional heat-flow model has been assumed within the device followed by two-dimensional heat flow into the heat sink. It is shown that a laser with stripe dimensions (13 mu m x 400 mu m) and typical thicknesses can achieve cw operation at heat-sink temperatures up to about 431^{0}K. At 300^{0}K, the theoretical power output is in the 40 to 50-mW range for J equals 2J/sub th/. The effects of varying thicknesses and the aluminum content in the GaAlAs confining layer are considered. The limitations of the calculation are discussed as well as its applicability to other stripe-geometry devices. (auth)

7204 OXYGEN-IMPLANTED DOUBLE-HETEROJUNCTION GaAs/GaAlAs INJECTION LASERS. Blum, J. M.; McGroddy,

J. C.; McMullin, P. G.; Shih, K. K.; Smith, A. W.; Ziegler, J. F. (IBM Thomas J. Watson Research Center, Yorktown Heights, NY). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 413-416(Jul 1975).

A new process for stripe formation in double-heterostructure GaAs/GaAlAs injection lasers is described. This process, which uses oxygen-ion implantation to form the stripe through a chemical doping effect, has several advantages over alternative methods, both with respect to device processing and device properties and has produced high yields of cw room-temperature lasers. Details of the device structure and fabrication processes are presented. The results of annealing studies, optical measurements, and lifetesting are described. (auth)

7205 STRIPED-SUBSTRATE DOUBLE-HETEROSTRUCTURE LASERS. Burnham, R. D.; Scifres, D. R.; Tramontant, J. C.; Alimonda, A. S. (Xerox Palo Alto Research Center, CA). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 418-420(Jul 1975).

A different type of stripe-geometry laser is demonstrated in which current confinement is achieved by selective diffusion of the n-type substrate prior to growth of the GaAs/GaAlAs heterostructure layers. This structure exhibits low room-temperature threshold currents resulting from the small lateral-current spreading from the edges of the stripe. Lowest order transverse-mode operation is achieved for stripe widths of 10 mu m. (auth)

7206 NEW HETEROISOLATION STRIPE-GEOMETRY VISIBLE-LIGHT-EMITTING LASERS. Itoh, K.; Inoue, M.; Teramoto, I. (Matsushita Electronics Corp., Takatsuki, Japan). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; Qe-11: No. 7, 421-426(Jul 1975).

Visible-light-emitting lasers were fabricated using a new stripe-geometry double heterostructure. The distinct feature of the geometry is the isolation of the contact stripe electrode to p-GaAs by the use of a layer of n-Ga/sub 1-z/Al/sub z/As epitaxially grown on top of p-GaAs. This geometry results in small internal strain, few crystal imperfections, and low thermal resistance in diodes so that high laser performance can be obtained. Lasing wavelengths as short as 7610 A and 6680 A have been attained in cw and pulsed operation, respectively, at room temperature. Various characteristic features of the lasers are described with regard to optical spectra, lasing thresholds, and external quantum efficiencies. (auth)

7207 TRANSVERSE-JUNCTION-STRIPE LASERS WITH A GaAs p-n HOMOJUNCTION. Namizaki, H. (Mitsubishi Electric Corp., Itami, Japan). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 427-431(Jul 1975).

A new semiconductor laser structure named the transverse-junction-stripe (TJS) laser, in which the active region is a GaAs p-n homojunction sandwiched between GaAlAs layers, has been developed. It is possible to operate the laser continuously at room temperature below 100 mA. The minimum threshold current is 34 and 50 mA in pulsed and continuous operation, respectively. Relatively high efficiencies have been obtained, comparable to those of conventional double-heterostructure (DH) lasers. The transverse mode is fundamental in both directions and is almost independent of input current up to three times the threshold current. The longitudinal mode stays nearly single over a wide range of input current. The TE/TM power ratio exceeds 100 at 1.5 times the threshold current. (auth)

7208 Al/sub x/Ga/sub 1-x/As DOUBLE-HETEROSTRUCTURE RIB-WAVEGUIDE INJECTION LASER. Lee, T. P.; Burrus, C. A.; Miller, B. I.; Logan, R. A. (Bell Labs., Holmdel, NJ). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No 7, 432-435(Jul 1975).

A "rib-guide" optical-waveguide structure proposed as a means of injection-laser transverse-mode control, independent of current distribution, has been demonstrated in an AlGaAs double-heterostructure diode laser. The new structure showed stable single-transverse-mode operation at currents to twice threshold with small rib dimensions, and the observed higher order modes in large structures are in reasonable agreement with theory. (auth)

7209 GaAs–GaAlAs DOUBLE-HETEROSTRUCTURE INJECTION LASERS WITH DISTRIBUTED FEEDBACK. Nakamura, M.; Aiki, K.; Umeda, J.; Katzir, A.; Yariv, A.; Yen, H. W. IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 436-439(Jul 1975).

GaAs–GaAlAs double-heterostructure distributed-feedback injection lasers are investigated at temperatures between 80 and 150°K under pulsed operation. The optical feedback for laser oscillation is provided by a corrugated interface between the p-GaAs active layer and the p-GaAlAs layer. The corrugation is made by two methods, ion milling and chemical etching, and the latter method is found to give the lower threshold. The laser oscillation occurs in a single longitudinal mode, whose wavelength is stable against the change of the excitation level. The temperature dependence of the wavelength of the distributed-feedback laser is shown to be 0.5 A/deg, which is about ⅓ to ¼ that of the conventional Fabry-Perot laser. (auth)

7210 SINGLE-HETEROSTRUCTURE DISTRIBUTED-FEEDBACK GaAs-DIODE LASERS. Burnham, R. D.; Scifres, D. R.; Streifer, W. (Xerox Palo Alto Research Center, CA). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 439-449(Jul 1975).

The fabrication, testing, and analysis of distributed-feedback (DFB) single-heterostructure (SH) electrically pumped GaAs lasers are reported. The techniques of fabricating the DFB grating and diode using interferometric exposure of photoresist, development, ion milling, liquid-phase-epitaxial growth, and diffusion are described in detail. Next, experimental results on a variety of diodes operating at 77°K are presented. It is shown that narrow laser linewidth (less than 0.15 A) and low threshold operation (775 A/cm^2) can be obtained. Also reported is output coupling from the grating which results in highly collimated laser beams with divergence of approximately 0.35°. Coupling coefficients, which determine laser threshold, are computed as a function of device parameters including physical dimensions, refractive indices, grating size and shape, and Bragg order for single- and double-heterostructure geometries. Calculated and measured thresholds are shown to be in good agreement. (auth)

7211 SEMICONDUCTOR LASERS WITH THE LIGHT OUTPUT THROUGH THE DIFFRACTION GRATING ON THE SURFACE OF A WAVEGUIDE LAYER. Alferov, Zh. I.; Andreev, V. M.; Gurevich, S. A.; Kazarinov, R. F.; Larionov, V. R.; Mizerov, M. N.; Portnoy, E. L. (Ioffe Physical-Technical Inst., Leningrad). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 449-451(Jul 1975).

In AlAs–GaAs semiconductor heterojunction lasers, due to the interaction of the waveguide modes with a diffraction grating on the surface of the waveguide layer, output of coherent radiation has been obtained through the plane parallel to the layer. The angle of divergence of the radiation in this case was equal to 0.5° both with optical and injection pumping. The possibility of fabricating a new type of semiconductor laser with small radiation divergence has been proven experimentally. (auth)

7212 GRATING-COUPLED DOUBLE-HETEROSTRUCTURE AlGaAs DIODE LASERS. Zory, P.; Comerford, L. D. (IBM Thomas J. Watson Research Center, Yorktown Heights, NY). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 451-457(Jul 1975).

Corrugated AlGaAs waveguide devices have been fabricated which emit low-divergence (approximately 1° by 15°) laser beams nearly normal to the waveguide plane when pulsed electrically at room temperature. The devices are fabricated from material which is essentially the same as that used to fabricate cw room-temperature lasers, differing only in that the two top layers of AlGaAs and GaAs are very thin (approximately 0.4 mu m and 0.1 mu m, respectively). Threshold current densities of 3000 to 4000 A/cm^2 are typical in these devices even though approximately 20 percent of the resonator length is unpumped. The far-field pattern produced by the TE polarized leaky-wave laser beams emanating from the unpumped region is usually composed of two mode lines. A theory is outlined which describes how these mode lines are generated. The possibility of obtaining distributed-feedback (DFB) oscillation in devices of this type is also discussed. (auth)

7213 INTEGRATED TWIN-GUIDE AlGaAs LASER WITH MULTIHETEROSTRUCTURE. Suematsu, Y.; Yamada, M.; Hayashi, K. (Tokyo Inst. of Tech.). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 457-460 (Jul 1975).

An integrated twin-guide (ITG) laser which has an active waveguide for laser oscillation and an external waveguide for the light output is proposed as an integrated-optics laser or as a new semiconductor laser and its properties are investigated theoretically and experimentally. ITG lasers were constructed in the form of an AlGaAs multiheterostructure, and their preliminary characteristics were obtained with both optical pumping and current injection at room temperature. The end mirrors of the active waveguide were fabricated by a back-sputtering method. The axial mode selectivity was predicted by the analysis and observed experimentally. (auth)

7214 MONOLITHIC Ga/sub 1-x/In/sub x/ AS DIODE LASERS. Doerbeck, F. H.; Lawley, K. L.; Blum, F. A.; Campbell, J. C. (Texas Instruments Inc., Dallas). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 464-467(Jul 1975).

Monolithic homojunction diode lasers have been fabricated from vapor-grown Ga/sub 1-x/In/sub x/As (0 less than or equal to

x greater than or equal to 0.06) mesa structures with grown optical facets. The Ga/sub 1-x/In/sub x/As lasers have been operated at 77^{0}K, and similar GaAs mesa devices have lased between 77 and 300^{0}K. Monolithic arrays of up to six mesa lasers on a single substrate have been operated with all lasers oscillating simultaneously. (auth)

7215 APPLICATION OF MOLECULAR-BEAM EPITAXIAL LAYERS TO HETEROSTRUCTURE LASERS. Casey, H. C.; Cho, A. Y.; Barnes, P. A. (Bell Telephone Labs., Murray Hill, NJ). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 467-470(Jul 1975).

GaAs-Al/sub x/Ga/sub 1-x/As double-heterostructure (DH) lasers with Si-doped n-type active layers have been prepared by molecular-beam epitaxy (MBE) and the laser properties evaluated. With 0.2-mu m-thick active layers and 300-mu m cavity lengths, typical room-temperature threshold current densities J/sub th/ of 5.0 x 10^3 A/cm^2 and best values of 2.5 x 10^3 A/cm^2 have been obtained. Stripe-geometry devices were run cw up to 9^{0}C. Photoluminescence (PL) studies of single layers grown with the donors Si, Ge, and Sn show that the luminescent intensity for MBE n-type layers depends on the substrate temperature during growth. The PL intensity for Sn-doped MBE layers was greater than for high-quality Sn-doped liquid-phase-epitaxial layers. (auth)

7216 LIQUID PHASE EPITAXIAL In/sub 1-x/Ga/sub x/P/sub 1-z/As/sub z//GaAs/sub 1-y/P/sub y/ HETEROJUNCTION LASERS. Coleman, J. J.; Holonyak, N. Jr.; Ludowise, M. J.; Wright, P. D.; Groves, W. O.; Keune, D. L. (Univ. of Illinois, Urbana). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 471-476(Jul 1975).

The growth and laser properties of In/sub 1-x/Ga/sub x/P/sub 1-z/As/sub z;;gaAs/sub 1-y/P/sub y/ single heterojunction laser diodes are described. High-quality p-type In/sub 1-x/Ga/sub x/P/sub 1-z/As/sub z/ layers are grown by liquid phase epitaxy (LPE) on n-type VPE GaAs/sub 1-y/P/sub y/ substrates of composition y equals 0.32 - 0.40. Laser operation (77^{0}K) of these quaternary-ternary heterojunctions is demonstrated at shorter wavelengths (less than 6300 A) and lower thresholds (J/sub th/ less than or equal to 6.2 x 10^{4}A/cm^2) than comparable GaAs/sub 1-y/P/sub y/ homojunctions. The increase observed in threshold current (5x) between y equals 0.38 and y equals 0.40 GaAs/sub 1-y/P/sub y/ substrates is attributed to the usual effect of E/sub CHI/ approaching E/sub GAMMA/ near the direct-indirect transition. From the well-defined cavity mode structure observed on these heterojunctions, data are obtained at relatively high energy on the index dispersion quantity [n - lambda(dn/d lambda)], which increases monotonically with photon energy and provides a reference for the distinctly different behavior observed on N-doped Ga/As/sub 1-y/P/sub y/ (h nu approximately E/sub GAMMA/ approximately E/sub N/). (auth)

7217 EFFICIENT InSb LASER WITH RESONANT LONGITUDINAL OPTICAL PUMPING. Menyuk, N.; Pine, A. S.; Mooradian, A. (Massachusetts Inst. of Tech., Lexington). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 477-481(Jul 1975).

External quantum efficiency of greater than 20 percent was achieved from tunable cw InSb lasers resonantly pumped with a CO laser. Thin InSb platelets at less than 10 K were pumped in a longitudinal geometry with the InSb recombination emission parallel to the CO radiation. Single-longitudinal-mode operation with power up to 10 mW was achieved with a 0.1 to 0.3-cm^{-1} linewidth, mechanically or thermally tunable over several cm^{-1}. Magnetic-field effects on the threshold and emission frequency were also studied. (auth)

7218 ANALYSIS OF OPTICAL SCATTERING IN DOUBLE-HETEROSTRUCTURE AND FIVE-LAYER HETEROSTRUCTURE (GaAl)As/Ga INJECTION LASERS. Thompson, G.H.B.; Kirkby, P. A.; Whiteaway, J.E.A. (Standard Telecommunication Labs., Ltd., Harlow, Eng.). IEEE (Inst. Electr. Electron. Eng.). J. Quant. Electron.; QE-11: No. 7, 481-488(Jul 1975).

The optical-absorption loss in (GaAl)As/GaAs heterostructure lasers with narrow active layers and passive layers doped below 5 x 10^{17} cm^{-3} should be less than 5 cm^{-1}. Measurements which have been made on a variety of three- and five-layer lasers have seldom shown such low figures. Optical-scattering loss at imperfections in the heterostructure interface could account for the discrepancy. An analysis of the scattering in both three- and five-layer heterostructures is presented. Curves are derived relating the absorption coefficient with the dielectric-constant step at the waveguide wall, the active-layer thickness, and the magnitude of the roughness. Measured losses as high as 12 cm^{-1} can be accounted for by a roughness amplitude of only 0.01 mu m. (auth)

7219 DEPOLARIZATION OF THE LASING EMISSION FROM CW DOUBLE-HETEROSTRUCTURE JUNCTION LASERS. Paoli, T. L. (Bell Telephone Labs., Murray Hill, NJ). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 489-494(Jul 1975).

Measurements of the polarization characteristics of the optical emission from cw Al/sub z/Ga/sub 1-z/As-Al/sub x/ga/sub 1-x/As double-heterostructure (DH) junction lasers are reported. Spectral observations demonstrate that in many lasers the lasing emission is not linearly polarized as expected from the conventional electromagnetic (EM) theory of the laser. A small but measurable field component is observed orthogonal to the main emission. In some lasers, the optical field is shown to be elliptically polarized, while in other devices the polarization state is more complex. The observed depolarization of the lasing modes is attributed to a strain-induced anisotropy in the dielectric properties of the laser waveguide. The anisotropic configuration which leads to elliptically polarized light is analyzed in detail and is shown to be equal to a pure shear in a plane parallel to the junction. (auth)

7220 THERMAL CHARACTERISTICS OF BURIED-HETEROSTRUCTURE INJECTION LASERS. Tsukada, T.; Shima, Y. (Central Research Lab., Hitachi Ltd., Tokyo). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 494-498(Jul 1975).

The thermal characteristics and cw operation of buried-heterostructure (BH) injection lasers, in which the GaAs active regions are completely buried in Ga/sub 1-x/Al/sub x/As, are described. The narrow active regions of these diodes facilitate effective heat dissipation. Thus, the cw operation of these lasers has been achieved without the p-GaAs layers usually grown in double-heterostructure (DH) lasers for electrical contacting purposes and with the heat dissipation through n-GaAs substrates. Even in this disadvantageous configuration, the temperature rise in the active regions of BH lasers at threshold is much smaller than that of p-side-down DH lasers. The calculation using an approximate formula can explain these low experimental values fairly well. Due to low operating current and effective heat dissipation, BH lasers can be operated continuously at room temperature on very small heat sinks such as TO-5 transistor headers. (auth)

7221 NEW TECHNIQUE FOR MEASURING THE THERMAL IMPEDANCE OF JUNCTION LASERS. Paoli, T. L. (Bell Telephone Labs., Murray Hill, NJ). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 498-503(Jul 1975).

A new method is presented to measure the temperature of the optical cavity of a junction laser as a function of the average electrical power supplied to the device. The technique relies upon a null measurement of the exact wavelength of a single Fabry-Perot mode and therefore does not require a preliminary calibration measurement. Because of the small linewidth of the mode, very small (less than 0.2^{0}C) temperature differences are easily measured. The method is utilized to obtain the thermal impedance for several different types of bonded stripe-geometry junction lasers. (auth)

7222 TRANSVERSE MODE CONTROL OF JUNCTION LASERS OPTICALLY COUPLED TO SINGLE-MODE FIBERS. Krupka, D. C.; Paoli, T. L. (Bell Telephone Labs., Murray Hill, NJ). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 503-507(Jul 1975).

Preliminary experimental results are reported to demonstrate that fundamental transverse mode operation can be obtained from a multimode double-heterostructure (DH) junction laser while simultaneously coupling its output into a single-mode optical fiber. Mode selection has been achieved by three different methods: (1) incorporating the fiber into the resonant cavity; (2) using the reflections off the diode-fiber interface; and (3) by a combination of the aforementioned methods. In all approaches the diode-fiber interface effectively becomes a mirror with a reflectivity which is higher for the fundamental mode than for all other modes of the DH waveguide. By using the reflections off the diode-fiber interface, a peak pulsed power of 80 mW has been obtained from the uncoated end of a single-mode fiber butted against a P-p-n-N junction laser. This laser radiated a peak power of 165 mW in a first-order mode when operated without coupling to the fiber. (auth)

7223 MULTIMODE OPERATION AND MODE-LOCKING EFFECT IN INJECTION LASERS. Bachert, H. (Central Inst. of Optics and Spectroscopy, Berlin); Eliseev, P. G.; Manko, M.A.; Strahov, V. P.; Raab, S.; Thay, C. M. IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 507-510(Jul 1975).

The oscillation regime of GaAs injection lasers has been investigated by methods of time-resolved spectroscopy and nonlinear interferometry. The relative roles of random and correlated process were studied. Spectroscopic data and interferometric investigations of laser samples in cw as well as in

pulse regimes show that in most cases multimode operation occurs with random phase fluctuations. However, in some cases signs of mode locking of longitudinal modes were observed with ultrashort pulsation. The duration time of the pulsation is estimated to be about 3 ps. (auth)

7224 ANOMALOUS INTERACTION OF SPECTRAL MODES IN A SEMICONDUCTOR LASER. Bogatov, A. P.; Eliseev, P. G.; Sverdlov, B. N. (Lebedev Inst. of Physics, Moscow). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 510-515 (Jul 1975).

Anomalous asymmetric interaction of the closely spaced spectral modes of a semiconductor laser is found experimentally in lasers with selective external cavities. The stimulated scattering of the laser radiation by dynamic inhomogeneities of the electron density is considered to be responsible for the anomalous mode interaction. (auth)

7225 INJECTION-INDUCED MODULATION OF LASER LIGHT BY THE INTERACTION OF LASER DIODES. Nishizawa, J. I.; Ishida, K. (Tohoku Univ., Sendai). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 515-519 (Jul 1975).

The experimental investigation of laser-light modulation by injecting laser light of a frequency, which is slightly different from the cavity resonant frequency, into a laser-diode cavity is reported. For this investigation, the interaction of two laser diodes was used and the relation between the oscillation frequency spectra and the lasing frequency difference of the two diodes was measured where the frequency difference was greater than the locking frequency range. The sidebands generated by the injection of laser light were measured to judge an appearance of the injection-induced modulation of light intensity. Modulation in the frequencies from 10 to 90 GHz was achieved by using laser diodes of 60 to 130-mu m length. It was experimentally shown that the upper frequency limit of the injection-induced modulation was related to the Q value of the laser-diode cavity. (auth)

7226 DIRECT MODULATION OF A DOUBLE-HETEROSTRUCTURE LASER USING A SCHOTTKY-BARRIER-GATE GUNN-EFFECT DIGITAL DEVICE. Yanai, H.; Yano, M.; Kamiya, T. (Tokyo Univ.). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 519-524 (Jul 1975).

From 4th European solid state device research conference; Nottingham, Eng. (Sep 1974).

By using a Schottky-barrier-gate Gunn-effect digital device the direct modulation of a GaAs-Al/sub x/Ga/sub 1-x/As double-heterostructure laser was achieved with a rise time of 250 ps. The dependence of the optical waveforms on the bias-current levels was investigated in detail. The results are compared with a rate-equation analysis. A discrepancy between the present theory and the experiment indicates the existence of an additional relaxation mechanism. (auth)

7227 SUPPRESSION OF INTENSITY SELF-PULSATIONS IN CW JUNCTION LASERS BY FREQUENCY-SELECTIVE OPTICAL FEEDBACK. Paoli, T. L.; Ripper, J. E.; Morosini, A. C.; Patel, N. B. (Univ. Estadual de Campinas, Brazil). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 525-527 (Jul 1975).

Suppression of the self-induced intensity pulsations from cw junction lasers has been achieved by operating the laser with frequency-selective optical feedback. The feedback is achieved by optically coupling a diffraction grating to a laser mirror. The feedback suppresses all longitudinal modes except one or two and thereby eliminates the mode interactions necessary for sustained optical pulsing. The experimental results directly support the previously proposed model for self-induced optical pulsing in semiconductor lasers. (auth)

7228 COMPREHENSIVE MODEL FOR Q SWITCHING IN SEMICONDUCTOR LASERS. Thomas, B. (Univ. of Wales, Cardiff, Eng.); Adams, M. J.; Gruendorfer, S. IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 528-532 (Jul 1975).

By combining a carrier concentration-dependent loss term with our earlier time-dependent saturable absorption loss term we have produced a comprehensive theory for Q switching which successfully accounts for the results so far reported. The concentration-dependent loss term shows a superlinear dependence with current due to the decrease of real guiding at the p-n junction. This increase in loss, however, reaches a maximum and shows a slight decrease at higher concentrations due to the onset of weak imaginary guiding. (auth)

7229 H-PULSING: A TRANSIENT EFFECT IN GaAs/Ga/sub x/Al sub 1-x/As INJECTION LASERS. Al Gruendorfer, S.; Adams, M. J.; Thomas, B. (Univ., Vienna). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 532-537 (Jul 1975).

"H-shape" light pulses, i.e., short light pulses superimposed on the beginning and end of a steady laser emission, are observed from pulsed single-heterostructure lasers operated at particular temperatures and currents. At a slightly higher current the steady laser emission is extinguished leaving the two peaks. The effect, observed in single-heterostructure lasers fabricated on low doped n-type substrates, was studied for various driving currents and laser temperatures. A theoretical study involving computations with standard laser parameters has resulted in light-output curves having a similar form. The rate equations computed contained a superlinear carrier-concentration-dependent loss term as well as the term for the emission of spontaneous photons into the laser mode. Loss of optical confinement due to carrier-induced changes in refractive index is proposed as an explanation for the superlinear carrier-dependent loss. (auth)

7230 DEGRADATION SOURCES IN GaAs--AlGaAs DOUBLE-HETEROSTRUCTURE LASERS. Ito, R.; Nakashima, H.; Kishino, S.; Nakada, O. (Hitachi Ltd., Tokyo). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 551-556 (Jul 1975).

Several sources of the dark-line defect (DLD) that causes rapid degradation of GaAs-AlGaAs double-heterostructure (DH) lasers have been identified by means of photoluminescence (PL) topography and a laser-induced degradation technique. All the sources that have been identified correspond to crystal defects, among which dark-spot defects (DSD) that are native to as-grown wafers are found to be most important. The growth and propagation processes of DLDs and DSDs have also been investigated. These defects are found to be highly mobile under high-intensity laser pumping. The correlation between the substrate dislocations and the DSDs has been examined by etching and x-ray topography. Although most DSD's correspond to etch-pits in epilayers, they are not always correlated with substrate dislocations. (auth)

7231 DEGRADATION IN INJECTION LASERS. Woolhouse, G. R. (IBM Thomas J. Watson Research Center, Yorktown Heights, NY). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 556-561 (Jul 1975).

The climb networks to be expected in an injection laser through electromigration and thermomigration are considered. It is shown that a model involving electromigration and dislocation pipe diffusion can explain the experimental results. It is predicted that thermomigration may be important in optically pumped devices. It is further shown that elastic strain, per se, cannot be responsible for the degradation. Where numerical reduction is appropriate, parameters of the GaAs-Ga/sub 1-x/Al/sub x/As system are used. The activation energy for pipe diffusion in GaAs is estimated to be 0.75 eV and the process is believed to be controlled by the diffusion of arsenic vacancies. (auth)

7232 DISLOCATION PINNING IN GaAs BY THE DELIBERATE INTRODUCTION OF IMPURITIES. Kirkby, P. A. (Standard Telecommunication Labs., Harlow, Eng.). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 562-568 (Jul 1975).

Recent work has shown that the primary cause of rapid degradation in GaAs-(GaAl)As lasers is the propagation of dark-line defects which originate at threading dislocations present in the as-grown material. This paper considers the effect of first-order elastic interactions between dislocations and deliberately added impurities, such as the commonly used dopants and group III or V impurities. Strongly interacting impurities tend to concentrate preferentially around dislocations in positions where they relieve stress, thus forming an impurity cloud. Subsequent movement of the dislocation then becomes energetically unfavorable. For impurities such as In, Sb, and N the pinning forces can be as large as 10^{10} dynes/cm^2. It seems likely that this type of dislocation pinning can be used to eliminate or greatly reduce the probability of a threading dislocation initiating a dark-line defect. (auth)

7233 POWER CALCULATIONS FOR HIGH-FLOW CO ELECTRIC DISCHARGE LASER SYSTEMS. Smith, N. S.; Hassan, H. A. AIAA Paper No. 75-36. New York; American Institute of Aeronautics and Astronautics (1975). 12p.

From 13th aerospace sciences meeting; Pasadena, CA, USA (20 Jan 1975).

A self-consistent model for high-flow electric discharge CO laser systems with coincident optical and flow axes is presented. The model employed couples the kinetics of the electrons and heavy particles with the optical and fluid dynamic processes in the laser system. The resulting integro-differential system of equations governing this multi-level system was solved by an exact numerical scheme. The effects of power input, composition, total mass flow rate and inlet pressure and temperature on the intensi-

ties and total power output were investigated. The results indicates that for a given input power and N_2 fraction, the efficiency increases by reducing the inlet temperature and increasing the velocity and/or the fraction of CO. Moreover, transitions on the lower vibrational bands can be obtained at the expense of lower efficiencies by reducing the CO fraction. (auth)

7234 NEW METHOD OF ELECTRON DENSITY MEASUREMENT APPLIED TO A cw 337 4m HCN GAS LASER. Belland, P.; Ciura, A. I.; Veron, D.; Whitbourn, L. B. (CEN, Fontenay-aux-Roses, France). J. Phys., E. (London); 8: No. 10, 866-870(Oct 1975).

A method of electron density measurement which may be applied to those continuous submillimeter wave lasers for which the lasing-mode spacing is larger than the laser emission linewidth is described. The foregoing condition, which is sufficient to ensure laser action in a single mode only, is satisfied by most submillimeter lasers. The experimental principle is the measurement of the electronic contribution to the resonant length for a fundamental mode of the laser resonator. The result is a double average of the laser discharge electron density across the dia of the laser resonator beam and along the length of the gas discharge. The use of a relatively narrow resonator beam reduces this double average to the longitudinal average of the central electron density to a good approximation. The method is applied to two 337 μm HCN laser gas discharges in 5 cm and 10 cm dia tubes, for conditions corresponding to maximum power output. The variation of electron density with gas pressure and discharge current is measured for both lasers. (auth)

7235 DEGRADATION AND INTENSITY FLUCTUATIONS IN CW AlGaAs DOUBLE-HETEROSTRUCTURE JUNCTION LASERS. Gonda, S. I.; Mukai, S. (Electrotechnical Lab., Tokyo). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 545-550(Jul 1975).

The intensity fluctuations in the output of cw AlGaAs semiconductor lasers were measured as functions of pumping current and operating time. The magnitude of fluctuation decreases with increasing aging time. The shift after degradation in the resonant-peak frequency for the normalized pumping rate is small. An increase of the half-width of the resonance peak is also observed, together with an increase of the threshold current and a decrease of the external differential quantum efficiency. The fluctuation spectra due to the quantum shot noise were calculated using rate equations with parametric variation of the pumping rate and the internal quantum efficiency. From the qualitative agreement between calculated and experimental results, changes in the intensity fluctuations after degradation are considered to be partly due to a decrease of the internal quantum efficiency or gain. (auth)

7236 GAIN PROFILE AND TIME-DELAY EFFECTS IN EXTERNAL-CAVITY-CONTROLLED GaAs LASERS. Rossi; J. A., Hsieh, J. J.; Heckscher, H. (Massachusetts Inst. of Tech., Lexington). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 538-544(Jul 1975).

An external dispersive cavity is used to map out the gain profile of single-heterostructure (SH), double-heterostructure (DH), and large-optical-cavity (LOC) lasers. The variations in gain profile with dopant and device operating conditions are reported. With certain cavity arrangements, long time delays in DH devices are observed; this shows that saturable absorption can be present in these as well as in all other types of GaAs diodes. A model combining saturable absorption with a breakdown in optical guiding makes it possible to consistently interpret all reported time-delay data for GaAs diffused-junction (DJ) and SH diode lasers, including Q-switching and abnormal-delay effects. Finally, experiments where where two gratings are used to oscillate a diode simultaneously at two different, independently variable frequencies are described. (auth)

7237 PULSEWIDTH OF THE MODE-LOCKED, INTERNALLY FREQUENCY-DOUBLED LASER. Falk, J.; Hitz, C. B. (GTE Sylvania Inc., Mountain View, CA). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 365-367(Jul 1975).

The variation in the output pulse duration of a mode-locked internally frequency-doubled (MLFD) laser was experimentally studied. The dependence of pulse duration on second-harmonic conversion rate and modulation index in a Nd:YAG laser is reported. The laser was frequency doubled by a barium sodium niobate crystal located inside the laser cavity and was mode locked by a quartz acousto-optic loss modulator. The observed variation of pulse duration with modulation depth and second-harmonic conversion rate is in good agreement with theory. The techniques reported should allow continuous variation of 1.06-mu m pulse duration from about 50 ps to greater than 900 ps to be obtained. (auth)

7238 HEATING IN A CW Nd-PENTAPHOSPHATE LASER. Weber, H. P.; Tofield, B. C. (Bell Telephone Labs., Holmdel, NJ). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 368-370(Jul 1975).

In a Kr-laser pumped cw Nd-pentaphosphate (NdP_5O_{14}) laser, with a threshold of 1.6 mW, an internal quantum efficiency of 63 percent is measured using a novel method. Bistable operation between oscillating and nonoscillating regimes is observed, resulting from the thermal lens created in the pumped zone. If stimulated emission is initially absent, this lensing effect is strong, making the resonator unstable and stimulated emission cannot build up. With stimulated emission initially present, heat development is reduced by the stimulated process itself and the resonator remains in the stable regime. For both situations, temperatures in the pumped area are determined using Raman spectroscopy. For the nonlasing situation, a fluorescence quenching rate of 68 percent, originating from Nd-Nd interactions is deduced, in close agreement with an earlier finding. (auth)

7239 AMPLIFICATION OF THE 1.32 mu m LINE IN Nd:YAG. Loree, T. R.; Sherman, L. M.; Thorne, J. M. (Los Alamos Scientific Lab., NM). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 371-372(Jul 1975).

Single-pass amplifier gains at 1.32 mu m have been measured in an 80-mm Nd:YAG rod, achieving a saturated gain of 3.1. Small-signal gain comparisons imply a stimulated-emission cross-section ratio (1.32/1.06 mu m) of 0.19. (auth)

7240 PUMPING OF RED CONTINUOUS-WAVE LASER DYES. Beisser, F. A.; Ellenberger, D. J. (Bell Telephone Labs., Holmdel, NJ). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 372(Jul 1975).

Two methods of operating red cw dye lasers are examined. A single laser with a mixture of rhodamine 6G and cresyl violet perchlorate (CVP) is compared with a tandem system in which a rhodamine 6G laser is used to pump a CVP laser. At high pumping levels the tandem system is shown to be superior. (auth)

7241 3547-A PUMPED HIGH-POWER DYE LASER IN THE BLUE AND VIOLET. Kato, K. (Japan Defence Agency, Meguro). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 373-374(Jul 1975).

Efficient generation of high-power dye-laser radiation in the blue and violet were achieved by pumping longitudinally with the third harmonic of a Nd:YAG laser. A peak power as high as 2.4 MW at 4890 A and peak powers in excess of 1.3 MW from 4300 to 5100 A were obtained. (auth)

7242 FIVE-YEAR OPERATION OF A He-Ne LASER. Kolb, W. P. (Hughes Aircraft Co., Torrance, CA). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 374-375 (Jul 1975).

A metal ceramic He-Ne laser has been operating on lifetest for over five years (greater than 47,000 h). During this period there has been no appreciable change in either the output power or the voltage-current characteristics of the unit. These results indicate the possibility of extremely long-life He-Ne lasers. (auth)

7243 INFLUENCE OF CONTAMINANTS ON THE CO_2 ELECTRIC-DISCHARGE LASER. Bletzinger, P.; LaBorde, D. A.; Bailey, W. F.; Long, W. H. Jr.; Tannen, P. D.; Garscadden, A. (Aerospace Research Labs., Wright Patterson AFB, OH). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 317-323(Jul 1975).

In CO_2-N_2-He electric-discharge lasers, small concentrations of impurities may be present in the original gases, or new species may be generated by the discharge. In order to determine the effects of such impurities, controlled amounts of possible contaminants were introduced into the amplifier of a CO_2 probe-amplifier system. Small-signal gain was reduced in all cases when CO, O_2, NO, N_2O, or NO_2 molecules were added. It was found that less than 0.1 percent of NO_2 or N_2O markedly reduces the laser gain and alters the discharge impedance. A discharge model which describes a three-component positive-column plasma (electrons, positive ions, and negative ions) yields results consistent with the observations. The influence of attachment and detachment rates on molecular gas discharge characteristics and stability are studied. (auth)

7244 THEORY OF FORCED MODE LOCKING. Haus, H. A. (Massachusetts Inst. of Tech., Cambridge). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 323-330(Jul 1975).

Differential equations are derived for forced mode locking of a homogeneously broadened laser in the frequency domain and time domain. Simple methods are presented for the analysis of pulse shapes for other than sinusoidal modulation. The higher order Hermite-Gaussian solutions of the synchronous sinusoidal modulation are shown to be unstable and hence unrealizable in the steady state. (auth)

7245 SPECTROSCOPY AND LASER OSCILLATION PROPERTIES OF LITHIUM NEODYMIUM TETRAPHOSPHATE. Otsuka, K.; Yamada, T.; Saruwatari, M.; Kimura, T. (Nippon Telegraph and Telephone Public Corp., Tokyo). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 330-335(Jul 1975).

Optical absorption, fluorescence, and laser characteristics of lithium neodymium tetraphosphate ($LiNdP_4O_{12}$, abbreviated as LNP) were examined. The crystal belongs to the monoclinic system (pseudoorthorhombic system) and the Nd content is 4.37 x 10^{21} cm^{-3}. The lifetime of the ^4F/sub 3/2/ level is 120 mu s, which is one-half of 230 mu s observed in Nd:YAG. The largest effective emission cross section at the line peak (1.047$_7$ mu m) was spectroscopically determined as 3.2 x 10^{-19} cm^2 for the electric vector parallel to the pseudoorthorhombic c axis and quantum efficiency was estimated as 0.48. Quasi-continuous laser oscillation pumped by a chopped Ar-ion laser was achieved with a 1.85-mm-long crystal. The output light was linearly polarized along the pseudoorthorhombic c axis of the crystal, which does not depend on the polarization direction of the pump light. The measured threshold and round-trip loss yield the value of 3.1 x 10^{-19} cm^2 for the effective emission cross section of LNP, which is in good agreement with the value obtained from the spectroscopic data. (auth)

7246 EFFECTS OF GAS ADDITIVES ON TEA CO_2 LASERS. Smith, A. L. S.; Bett, T. H.; Browne, P. G. (Univ. of St. Andrews, Fife, Scotland). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 335-340(Jul 1975).

The effects of the selective addition of the gases H_2, CO, O_2, NO, and NO_2, and N_2O on the output peak power and stability of a flowing-gas TEA laser operating with a basic mixture of CO_2, N_2, and He are examined. These additive gases are possible products of reactions which occur in the discharge region of the laser and have considerable bearing on the operation of a sealed TEA laser. The power output is increased with the limited addition of H_2 (approximately 5 percent) or NO (approximately 0.2 percent), whereas N_2O, NO_2, O_2, and CO reduce the power output when present in any amount; 50 percent reduction being obtained with approximately 0.23 percent N_2O; approximately 0.15 percent NO_2, approximately 4 percent O_2, and approximately 22 percent CO. H_2 (and possible NO) limits the transition from a diffuse glow to arc discharge by allowing a larger range of operating conditions, whereas CO reduces the range of operating conditions for stable operation. O_2 does not affect the discharge, whereas N_2O and NO_2 both encourage the transition to arcing. (auth)

7247 PULSED OPERATION OF AN OPTICALLY PUMPED FAR-INFRARED MOLECULAR LASER. Bluyssen, H. J. A.; McIntosh, R. E.; van Etteger, A. F.; Wyder, P. (Univ. of Nijmegen, Netherlands). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 341-348(Jul 1975).

An investigation of the far-infrared (FIR) response of an optically pumped molecular laser to an infrared (IR) pulse source is presented. It is shown that a three-level laser model explains the observed amplitude and delay of FIR output pulses when a reduction factor for participating molecules is included in the model. A discussion of those physical mechanisms that might be responsible for the reduction factor is given along with a description of how the FIR laser's performance depends on various physical parameters. (auth)

7248 EFFECT OF ROTATIONAL AND INTRAMODE VIBRATIONAL COUPLING ON SHORT-PULSE AMPLIFICATION IN CO_2. Harrach, R. J. (Univ. of California, Livermore). IEEE (Inst. Electr. Electron. Eng.) J. Quant. Electron.; QE-11: No. 7, 349-357(Jul 1975).

The extraction of stored energy from a CO_2-laser amplifier by a short-duration input pulse is described using a rate-equation theory. The influence of rotational and intramode vibrational energy-transfer processes is studied as a function of the energy density E/sub in/ and width tau/sub p/ of the input pulse. By a suitable choice of normalized variables delta and E/sub in//E/sub sat/ for the extracted-energy and input-energy density, it is found that the results for different values of tau/sub p/ are interrelated by simple translations in a delta versus E/sub in//E/sub sat/ diagram. The characteristic curves in this diagram are nearly independent of the amplifier gain factor exp ($alpha_0L$) for high-gain systems. A comparison of the theory with experimental results of Figueira et al. shows satisfactory agreement and leads to an estimate of (1.0–3.5) 10^6 s^{-1} $torr^{-1}$ for the rate of intramode vibrational-vibrational energy transfer in CO_2. (auth)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 7092, 7097, 7147, 7914, 7917, 7919, and 7928.

7249 (CONF-751125-37) PROPAGATION OF NORMAL ZONES IN COMPOSITE SUPERCONDUCTORS. Dresner, L.; Miller, J. R.; Donaldson, G. W. (Oak Ridge National Lab., Tenn. (USA)). 1975. 6p. Dep. NTIS $4.50.

From 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

Propagation velocities of normal zones in a multifilamentary composite conductor were measured for a range of magnetic fields and operating currents. The degree of thermal contact of the conductor with the helium bath was varied, the conductor having been bare, insulated by a thin Formvar layer, or completely potted in wax. The measurements were compared with theory, and good agreement was achieved by suitably choosing the heat transfer coefficient. (auth)

7250 (IPP-4/127) SOME BASIC PROBLEMS IN THE DEVELOPMENT OF FAST SWITCHING SC/NC CURRENT BREAKERS (CRYOTRONS). Pillsticker, M. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Dec 1974. 44p. (In German). INIS.

11 figs.; 1 tab.; 18 refs.

Special technical problems of fast switching sc/nc current breakers (cryotrons) are reported. At first typical requirements for these breakers are defined. The importance of specific parameters, for instance relations between ohmic resistance of superconductors, temperature, and materials, as well as parameters affecting the switching time, such as trigger energy and electrical conditions of the trigger circuit are explained. The stability of the breaker material in the superconductive state is considered in general, while constructive possibilities bearing upon the stability are discussed more exactly. Problems of dimensioning taking notice of important facts are reported and formal relations are given. The special possibilities of triggering a breaker are discussed. Advantages and disadvantages of triggering by current-pulse and magnetic field pulse are explained, because these are the methods for triggering fast switching breakers. Some breaker concepts are given which may serve as a basis for the development of large fast switching breakers. By connecting these parts in parallel and/or in series, it is possible to switch very high currents, the resistance of the breaker can be changed as necessary, and the breakdown voltage of a breaker may be very high. (auth)

7251 (KFK-2102) PULSABLE SUPERCONDUCTING 28 KJOULES-SOLENOID. Juengst, K. P.; Obermaier, G. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Experimentelle Kernphysik). Oct 1975. 21p. (In German). Dep. NTIS (US Sales Only) $4.50.

The construction and test of a pulsable superconducting solenoid magnet (PUSSY) is described. The magnet has a cold bore of 80 mm dia, and reached a central field of 4.75 T after the first run. The field homogeneity is 0.1% in 30 mm dsv and 1% in 60 mm dsv. The peculiarities of this solenoid are the fully insulated braid conductor, consisting of 32 multifilament wires with 206 NbTi filaments each, and the application of copper heat drains for the cooling of the magnet windings. The magnet reached a rate of field change of 2 T/s or 630 A/s without significant degradation with respect to dc operation. (auth)

7252 (LA-6117-PR) SUPERCONDUCTING MAGNETIC ENERGY STORAGE PROJECT AT THE LOS ALAMOS SCIENTIFIC LABORATORY. Progress Report, January 1–March 31, 1975. Hassenzahl, W. V. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-eng-36. 15p. Dep. NTIS $4.00.

Details are reported on the design of a 100-MJ superconducting magnetic energy storage system. Superconducting wire of a type which may be used in the 100-MJ model has been ordered and a small test coil has been designed to test the wire and the winding technique to be used on the 100-MJ coil. (auth)

Heat Transfer and Fluid Flow

Refer also to abstracts 7270, 7271, 8743, and 8750.

7253 (IKE-5-182E) LAWS OF TURBULENT FLOW IN PIPES AND CHANNELS. A Scientific Paper. Hofmann, G. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Aug 1974. 426p. (In German). INIS.

76 figs.; 7 tabs.; 322 refs. Available from ZAED.

With a list of 322 publications, some of which have only recently been published, with 92 sketches and diagrams and 12 tables, the paper gives a survey on the present state of research on turbulent flow in pipes and ducts. Also included is a chapter on the analogy between impulse, heat, and material transfer, which provides the basic knowledge for a quick understanding of the most recent

research findings in the field of heat and material transfer which are constantly being published. (auth)

7254 CAVITY FLOWS. Fluids Engineering Conference, Minneapolis, MN, May 5-7, 1975. Parkin, B. R.; Morgan, W. B. (Eds.). New York; American Society of Mechanical Engineers (1975). 143p. (CONF-750580-). $15.00.

From the fluids engineering conference on cavity flows; Minneapolis, Minnesota, USA (5 May 1975).

The fifteen papers given at the cavity flow conference are presented. Information is included on cavitation flow experiments with propeller blades, turbines, turbopumps, and hydrofoils, and theoretical studies of the characteristics and effects of cavity flows. (LCL)

7255 CAVITATION AND POLYPHASE FLOW FORUM, 1975. Joint Meeting of Fluids Engineering and Lubrication Division, Minneapolis, Minnesota, May 5-7, 1975. Waid, R. L. (ed.). New York; American Society of Mechanical Engineers (1975). 34p. (CONF-750558-). $7.00.

The nine papers which comprise the 1975 Forum present a wide range of primarily experimental studies of cavitation and polyphase flows. These papers include the polyphase mechanism in froths, the cavitation collapse pressures in venturi flow, the effects of test conditions on developed cavity flow, a cavitation hypothesis for geophysical phenomena, the character and design of centrifugal pumps for cavitation performance, and the effect of fluid and magnetic and electrical fields on cavitation erosion. (auth)

Materials Testing

Refer also to abstract 8726.

7256 (AED-CONF-75-179-003) TRENDS IN ULTRASONIC TESTING WITH RESPECT TO REACTOR SAFETY. Mundry, E.; Wuestenberg, H.; Neumann, E.; Kutzner, J.; Nabel, E. (Bundesanstalt fuer Materialpruefung, Berlin (F. R. Germany)). 1975. 12p. (In German). INIS.

From lecture meeting of the Deutsche Gesellschaft fuer Zerstoerungsfreie Pruefverfahren e.V.; Berlin, F. R. Germany (6 May 1975).

The paper deals with economic, personnel, and technical aspects of ultrasonic testing. Also discussed are problems of failure location and of the interpretation of the measured values. Finally, special aspects of automatic testing as opposed to manual testing are discussed. (auth)

7257 OIL AND CHEMICAL PLANT CONSTRUCTORS' ASSOCIATION. Code of Practice for Site Radiography. London; Kluwer-Harrap Handbooks (1975). 60p.

The Code of Practice is set out in Parts, entitled: introduction; administrative organization (including organization for radiological protection, medical supervision, personal monitoring, transfer record, control of sealed sources, equipment tests, site visits); operator competence; equipment (including x-ray equipment, gamma ray equipment, pipeline crawler equipment, safety equipment); methods of work; carriage of sources by road; emergency procedures (including sections dealing with (a) x-ray apparatus, (b) radioactive substances in use, and (c) radioactive substances not in use); legal considerations. (UK)

7258 CHECKING OF RADIATION SOURCES FOR GAMMA FLAW DETECTORS. Pontus, L. A.; Nikiforova, Z. S. Meas. Tech. (USSR) (Engl. Transl.); 18: No. 5, 790-792(May 1975).

Translated from Izmer. Tekh.; 18: No. 5, 93-94(May 1975).

One of the main parameters of gamma sources is the strength of the exposure dose created by the source at a distance of 1 m. The gamma-sources ^{60}Co, ^{137}Cs, and ^{192}Ir which are used in flaw detectors should create exposure dose strengths which differ from the nominal values by not more than ±25%; otherwise the gamma source is unsuitable for use in flaw detectors. Since the strength of the exposure dose varies with time, it is advisable to check the gamma sources periodically. In checking, the practice is to determine the strength of the exposure dose created by the source at a distance of 1 m and check how it corresponds with the standards. The period between checks on the gamma sources of the flaw detectors which are in use is set by the state or departmental metrological services in accordance with the half-lives of the sources, the conditions of their use, and the actual need. The main requirements for the equipment are formulated and methods are described for checking gamma sources for flaw detectors. (WHK)

Nuclear Explosions

Refer also to abstract 7267.

7259 (PNE-Rb-70) PROJECT RIO BLANCO REENTRY DRILLING AND TESTING OF RB-E-01 WELL. Final Report. (CER Geonuclear Corp., Las Vegas, Nev. (USA)). Oct 1975. 140p. Dep. NTIS $7.00.

Reentry by the RB-E-01 hole was made through the 7-in. emplacement casing. Details of the drilling operations and test results are presented. (TFD)

7260 (PNE-RB-71) VIBRATION RESPONSE AND EVALUATION OF OIL SHALE MINE OPENINGS TO THE RIO BLANCO EVENT. Munson, R. D. (Bureau of Mines, Dever, Colo. (USA). Denver Mining Research Center). 10 Jul 1975. Contract AT(29-2)-914. 59p. Dep. NTIS $5.50.

Project Rio Blanco was designed to further study the economic and technical feasibility of the commercial development of natural gas, using underground nuclear explosions to stimulate production. Simultaneous detonation of the three, 30 kt devices took place on May 17, 1973, at 10:00:00.12 hours +-0.01 second, M.D.T. The initial compressional impulse was evident on all data channels at the Colony, Anvil Points and Dutch Creek No. 1 Mines. Other phases were not readily identifiable due to the complexity of the seismic signals. Recorded particle velocity and acceleration were, in general, near that predicted for the event. Particle velocity was directly recorded from all station points. Acceleration was directly recorded only from selected stations for comparative purposes. Displacement was derived for all station points from recorded particle velocity and/or acceleration. Propagation velocity was calculated to be 13,950 feet/second to the Colony Mine and 15,800 feet/second to the Anvil Points Mine. In view of the fact that both mines lie very nearly on a common line to ground zero, a higher velocity to the Anvil Points mine is unique. This may indicate the presence, at depth, of a high velocity refraction layer through which the seismic wave to both mines was transmitted. Loss of the transmitted time signal at the Dutch Creek No. 1 mine station prevents calculation of the propagation velocity. (auth)

7261 (UCID-16910(Pt.1)) LLL DBASE GLOSSARY AND PARAMETER DEFINITIONS, PART 1. Rohrer, R. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Oct 1975. Contract W-7405-Eng-48. 63p. Dep. NTIS $5.45.

This report lists, defines, and updates parameters in DBASE, an LLL test effects data bank in which data are stored from experiments performed at NTS and other test sites. Parameters are listed by subject and by number. Part 2 of this report presents the same information for classified parameters. (auth)

7262 (UCRL-52000-75-10, pp 20-25) NUCLEAR CHEMICAL MINING FOR COPPER RECOVERY. Oct 1975.

In Lawrence Livermore Laboratory energy and technology review. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

To meet projected domestic demand for copper, deeper ore deposits will have to be exploited and a technology developed for processing these ores. LLL has investigated combining nuclear technology and in situ leaching to recover copper ores from deposits too deep to be mined economically by conventional techniques. The chemical mining concept involves emplacing nuclear explosives below the water table in a deep-lying copper deposit, detonating these explosives to rubblize the rock, and then passing oxygen and water through the rubblized zone to leach out the copper as copper sulfate. The copper sulfate is then brought to the surface where liquid ion exchange and electrowinning are used to remove the copper. Technical evaluations of this chemical mining process have been favorable. In 1973, LLL teamed with the Kennecott Copper Corporation and ERDA to consider the feasibility of commercializing the process. The resulting joint study affirmed the technical feasibility of nuclear chemical mining and identified the process uncertainties that must be resolved before its commercial feasibility can be assured. (auth)

7263 STIMULATION OF SEISMIC WAVES BY UNDERWATER EXPLOSIONS. Wielandt, E. Karlsruhe, Ger.; Karlsruhe Univ. (1972). 120p. (In German). INIS.

Thesis.

Theoretical investigations of the source signal of underwater explosions and the comparison with measurements made are dealt with. A FORTRAN program for the numerical calculation of the volume of the explosion gases as a function of time, load and water depth is described. For seismic purposes, the second derivative of the volume with respect to time is approximated by a simple impulse series. Thus a closed formula can be given for the FOURIER spectrum of the source signal. (GE)

7264 STUDY OF THE EFFECT OF THE PARAMETERS OF THE SURROUNDING MEDIUM ON THE FINAL DIMENSIONS OF THE CAVITY IN A STRONG BURIED EXPLOSION. Batalov,

V. A.; Svidinskii, V. A. Izv. Acad. Sci., USSR, Phys. Solid Earth (Engl. Transl.); No. 12, 837-841(1971).

Translated from Izv. Akad. Nauk SSSR, Fiz. Tverd. Zemli; No. 12, 24-31(Dec 1971).

Numerical calculations are made of the effects of the rigidity parameters of the medium and of the parameters of the explosion products on final cavity dimensions. Much detailed data are presented. The principal results are: (1) the final dimensions of the cavity are relatively insensitive to variation in Poisson ratio; (2) doubling the Gruneisen constant only decreases the cavity by 12%; (3) the effect of adiabatic heating by the shock wave is negligible; (4) use of the correct equation of state is important; (5) the final dimensions are extremely sensitive to yield point; (6) charges of the same weight but different dimensions will produce different size cavities; and (7) radial fracturing tends to decrease the size of the cavity. The computations in general agree with the GNOME and SALMON field results. (Appl. Mech. Rev.)

Protective Structures and Equipment

7265 (KFK-2165, pp 9-21) DEVELOPMENT OF EXHAUST AIR FILTERS FOR REPROCESSING PLANTS. Furrer, J.; Kaempffer, R.; Wilhelm, J. G. Jun 1975. (In German).

5 figs.; 9 tabs.

In annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Lab. fuer Filtertechnik).

The reaction behavior of organic iodine compounds on inorganic iodine sorption material was investigated. Laboratory tests were conducted to measure the utilization of the filter capacity. the removal profile and the removal efficiency of the highly impregnated iodine sorption material planned for use in the head end iodine removal unit of a 1,500 t/a reprocessing plant for LWR fuel. Preliminary tests of head end iodine stripping from the dissolver and the acid recovered are described. (auth)

7266 (KFK-2165, pp 22-32) FILTERING REACTOR EXHAUST AIR, IDENTIFICATION OF IODINE COMPOUNDS IN REACTOR OFF-GASES. Furrer, J.; Kaempffer, R.; Wilhelm, J. G. Jun 1975. (In German).

3 figs.; 7 tabs.

In annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Lab. fuer Filtertechnik).

First studies on the development of a discriminating sampler for selective removal of fission iodine components are described. The results of further work on investigations of the volatility of hypoiodous acid are indicated. Measurements of the loading of iodine filters in nuclear power stations with pollutants and its effects upon the removal efficiency are outlined. The results of in-situ tests of iodine filters in nuclear power stations and of laboratory tests of the sorption material from iodine filters are covered. (auth)

7267 (UCRL-52000-75-10) LAWRENCE LIVERMORE LABORATORY ENERGY AND TECHNOLOGY REVIEW. Carr, R. B.; McCaleb, C. S.; Prono, J. K. (eds.). (California Univ., Livermore (USA). Lawrence Livermore Lab.). Oct 1975. Contract W-7405-Eng-48. 30p. Dep. NTIS $5.00.

Separate abstracts were written for the four sections of the report. One section was included in ERDA Research Abstracts but not in Nuclear Science Abstracts. (SFL)

For abstracts of individual sections see: 7262, 7268, and 7403.

7268 (UCRL-52000-75-10, pp 11-14) SAFETY LIMITS OF HALF-MASK CARTRIDGE RESPIRATORS FOR ORGANIC SOLVENT VAPORS. Oct 1975.

In Lawrence Livermore Laboratory energy and technology review. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

Recent studies of the effective service life (safety limits) for typical half-mask cartridge respirators have shown these devices to be unsuitable for certain organic vapors, e.g., methanol, methylamine, vinyl chloride, and dichloromethane, because the effective service life is too short. For these vapors other forms of protection such as air-supplied respirators are recommended. The experimentally determined service life for many vapors is shorter--sometimes significantly shorter--than predicted by adsorption theory. (auth)

Safety Engineering

7269 (LA-6125-PR) CONTAMINATION LIMITS FOR REAL AND PERSONAL PROPERTY. Progress Report, January-June 1975. Wenzel, W. J.; Healy, J. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-ENG-36. 4p. Dep. NTIS $4.00.

Data for the movement of various contaminants (^{89}Sr, ^{131}I, ^{32}P) from several different laboratory surface materials and textiles were examined and the fractional amount removed per unit time fitted to an arbitrary scale of level of action. Both the nature of the contaminant and the nature of the surface appear to affect the fractional removal although data are not available to define the dependence in any detail. (auth)

Vacuum Engineering

7270 (ERDA-tr-71) ANALYSIS OF MOLECULAR FLOW PARAMETERS WITH THE HELP OF KINETIC VALLANDER EQUATIONS. Ershov, B. D.; Saksaganskii, G. L. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1973. Translation of NIIEFA-A-0182. 18p. Dep. NTIS (US Sales Only) $4.00.

A technique is given for calculating the macroscopic parameters of a molecular flow and the capture coefficients of vacuum structures with sorbing walls. The basic analytical relationships and diagrams are presented. The possible advantages of the proposed method in comparison with the Monte Carlo method and methods based on the theory of radiant heat exchange are discussed. (auth)

7271 (ERDA-tr-72) GAS-KINETIC ANALYSIS OF MULTICOMPONENT VACUUM SYSTEMS BY THE METHOD OF EQUIVALENT SURFACES. Ershov, B. D.; Sakaganskii, G. L. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1974. Translation of NIIEFA-A-0219. 16p. Dep. NTIS $4.00.

A method is proposed for the analysis of molecular flows in complicated vacuum systems. Essentially, it involves the transposition of solutions for a number of elemental structural components. The basic analytic relationships and tables are given and the method is illustrated by analyzing a specific system. (auth)

ENVIRONMENTAL AND EARTH SCIENCES

7272 (ATDL-75/17) 1974 ANNUAL REPORT. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.). Sep 1975. 240p. Dep. NTIS $10.60.

Separate abstracts were prepared for 12 sections of this report. Six items have been announced in Nuclear Science Abstracts and all twelve items have been announced in ERDA Research Abstracts. (CH)

For abstracts of individual sections see: 7339–7343, and 7346.

7273 NITROGEN-15 STUDIES ON IDENTIFYING FERTILIZER EXCESS IN ENVIRONMENTAL SYSTEMS. Freyer, H. D., Aly, A. I. M. (Nuclear Research Center, Juelich, Ger.). pp 21-33 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The feasibility of identifying fertilizer excesses in surface and ground waters on the basis of variations in the isotope ratio of nitrogen has been studied. The isotope ratio of the commonly used ammonium and nitrate fertilizers is similar to that of atmospheric nitrogen. These ratios are shifted when fertilizers are added to the soil. In the soil, fertilizer ammonium is oxidized and the nitrate formed is reduced in the heavy isotope. The fractionation factors are calculated. This artificially added nitrate becomes mixed with natural nitrate which, in general, is enriched in the heavy isotope. Only 50 percent (or even less) of the nitrate formed may stem from the added fertilizer. The mixing ratios are time-dependent, and different for various types and conditions of soil. In spite of this complexity, information on this isotope process should be obtainable, if the isotope ratios of artificial and natural nitrate, respectively, are substantially different. Surface waters, in general, show no significant correlation between nitrate content and isotope ratio due to additions of sewage waters. Some data on ground waters from agricultural areas, however, where the nitrate content apparently resulted from fertilizers, gave a negative correlation of lower isotope ratios with higher nitrate contents. An inverse correlation was found in the isotope ratios of nitrate in untouched surface waters, and they even reflect the composition of the total soil nitrogen. (auth)

7274 ATTEMPT TO CHARACTERIZE CERTAIN ORGANIC AND MINERAL SUBSTANCES BY THEIR STABLE ISOTOPE COMPOSITION. Bricout, J. (Institut de Recherches Appliquees aux Boissons, Creteil, France); Fontes, J. C.; Letolle, R.; Mariotti, A.; Merlivat, L. pp 359-372 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975). (In French)

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The determination of the relative abundance of various stable isotopes–deuterium, oxygen-18, carbon-13, nitrogen-15, sulphur-34–can be used to characterize the origin of a water body and of an organic or mineral substance in the environment. This results from the discovery that isotopic fractioning by living organisms occurs. The stable isotope composition of any substance reflects, at least partly, the various stages of its formation. A number of examples supporting this hypothesis are given. The passage of water through plants, or alcoholic fermentation, substantially modifies the stable isotope composition of water. The assimilation of atmospheric carbon dioxide involves a reduction in the carbon-13 content which varies depending on the enzymatic mechanism of photosynthesis. The enzymatic reactions that cause the biosynthesis of various organic substances in higher plants are accompanied by partial exclusion of deuterium, an exclusion which is greater or smaller depending on the biosynthesis pathway followed. The bacterial reduction of sulphur compounds involves a high rate of isotopic fractioning. As a result, industrial sulphates obtained by oxidation of reduced sulphur associated with hydrocarbon deposits are depleted in ^{34}S in comparison with natural sulphates. Similarly, the authors have observed that nitrates produced by the plant biological cycle are rich in nitrogen-15 compared to synthesized nitrates. (auth)

7275 SURVEY OF THE FISH POPULATIONS OF THE MIDDLE SEVERN ESTUARY BASED ON POWER STATION SAMPLING. Hardisty, M. W.; Huggins, R. J. (Univ. of Bath, Eng.). Int. J. Environ. Stud.; 7: No. 4, 227-242(1975).

Over a period of a year, weekly 24-hour samples have been taken of fish species collected from the screens of the Oldbury-on-Severn Nuclear Power Station in the Middle Severn estuary (U.K.). The faunal list consists of 48 species compared with the 44 species recorded in a 3-year survey (based on the examination of commercial catches) made over 30 yrs earlier. Numbers of fish as well as variety of species increased through the autumn and winter, reflecting in part, a seasonal movement of several gadoid species into the estuary. The Power Station samples contained some species not previously recorded specifically for the Oldbury region often in considerable numbers. A short description of the biological characteristics and seasonal changes in frequency is given for each of the more important estaurine species. (auth)

Minerals and Ores

Refer also to abstracts 6945 and 8816.

7276 (COO-3462-12) FISSION-TRACK STUDY OF THE URANIUM BIO-GEOCHEMISTRY IN CARBONATES OF BIKINI AND ENEWETAK ATOLLS. Progress Report, July 1, 1974–December 31, 1975. Levy, Y.; Miller, D. S.; Friedman, G. M.; Goter, E. R. (Rensselaer Polytechnic Inst., Troy, N. Y. (USA). Dept. of Geology). Sep 1975. Contract E(11-1)-3462. 35p. Dep. NTIS $5.00.

Major contributions during this contract period have been in developing an analytical procedure for Pu measurement, and in applying the developed procedures to determining the plutonium concentration and distribution in coral from the Bikini Atoll. In conjunction with these contributions, measurements using the fission-track method have been made of the uranium distribution and concentrations in several carbonate samples from drill cores obtained from the Runit Island Enewetak Atoll. Petrographic studies on these drill core samples have been made to correlate the uranium data with the mineralogical data. (auth)

7277 (EGG-1183-1630) INTERIM STATUS OF THE TEXAS URANIUM SURVEY EXPERIMENT. Jupiter, C.; Wollenberg, H. (EG and G, Inc., Las Vegas, Nev. (USA)). 26 Apr 1974. 34p. Dep. NTIS $4.00.

The objective of the Texas uranium survey experiment is to evaluate an improved method for prospecting for uranium by determining correlations among (a) geologic analysis, (b) soil sample radiochemical analysis, (c) aerial radiometric data, (d) aerial infrared scans, and (e) aerophotographic data. Although aerial radiometric measurements have been used previously in mineral prospecting, the development of useful correlative techniques based on analysis of data from large terrestrial areas employing the five parameters (a through e, above) remains to be evaluated, and could be of significant value to the need for establishing uranium resource pools to meet the nation's energy crisis. The Texas uranium survey field experiment began on June 13, 1973, employing a Martin-404 aircraft to fly gamma-ray recording equipment at a 500-ft altitude over two areas in southeast Texas. The areas surveyed are referred to as the Dubose area (approximately 120 sq. miles) and the Clay West area (approximately 24 sq. miles). This document briefly summarizes the work which has been done, describes the kind and quality of calibrations and data analysis carried out thus far and outlines recommended additional work which would bring the experiment to some degree of completion, providing a basis for evaluating the techniques. (LK)

7278 GEOTHERMAL EXPLORATION. Hardison, J. E. (to Atlantic Richfield Co.). US Patent 3,874,232. 1 Apr 1975. Filed date 15 Jun 1972. 6p.

A uranium prospecting system based on the determination of temperature anomalies in the earth's crust is described. The earth heat flux is measured at preselected points in shallow boreholes in order to detect heat given off as a result of radioactive decay. Localized anomalies are indicative of concentrations of radioactive materials. (auth)

Radioactivity Monitoring and Transport

Refer also to abstract 7323.

7279 (AAEC/E-366) RUM JUNGLE ENVIRONMENTAL STUDIES. Summary Report. Watson, G. M. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Sep 1975. 28p. Dep. NTIS (US Sales Only) $5.00.

Sources of pollution at the Rum Jungle uranium mine were identified and their relative importance assessed. Observations were made on seasonal variations and differences were noted between the dispersion patterns of several metals of interest. The geographical extent of chemical and biological pollution and radioactivity was examined. Some understanding of the basic mechanisms involved in continuing pollution was obtained and an attempt was made to determine the fate of heavy metals. (auth)

7280 (BNWL-SA-5451) RADIONUCLIDES IN CANADA GOOSE EGGS. Rickard, W. H.; Sweany, H. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 12p. (CONF-750985-1). Dep. NTIS $4.50.

From 15th Hanford life sciences symposium; Richland, Washington, USA (25 Sep 1975).

Low levels of radionuclides were measured in Canada goose eggs taken from deserted nests from Columbia River islands on the Energy Research and Development Administration's Hanford Reservation. Potassium-40, a naturally occurring radionuclide, was the most abundant radionuclide measured in egg contents and egg shell. Strontium-90 was incorporated into egg shells and cesium-137 into inner egg contents. Manganese-54, cobalt-60, and zinc-65 were more abundant in inner egg contents than in egg shell. Cerium-144 was detected in egg shell but not in inner shell. (auth)

7281 (BNWL-SA-5484) ASSOCIATION OF LONG-LIVED RADIOACTIVITY WITH SEDIMENT ALONG THE COLUMBIA RIVER SHORELINE, ISLANDS, BOTTOM AND SLOUGH AREAS. Fix, J. J. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 30p. (CONF-750967-20). Dep. NTIS $5.00.

From 3rd ERDA environmental protection conference; Chicago, Illinois, USA (23 Sep 1975).

Since deactivation of the last once-through cooling production reactor in January 1971, radioactivity associated with sediments or biota in the Columbia River attributable to past Hanford operations decreased to very low levels. Currently only a few long-lived radionuclides are measurable and generally due to the association of these radionuclides with sediments in the river. The data available from several different monitoring programs provide a preliminary description of the extent, concentration, and physical form of these radionuclides. Data are presented on ^{137}Cs, ^{60}Co, ^{65}Zn, and ^{152}Eu in sediments sampled in 1974. (CH)

7282 (BNWL-SA-5494(Pt.1)) MONITORING AND CHARACTERIZATION OF RADIONUCLIDE TRANSPORT IN THE HYDROGEOLOGIC SYSTEM. Phillips, S. J.; Raymond, J. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 23p. (CONF-750967-15). Dep. NTIS $4.25.

From 3rd ERDA environmental protection conference; Chicago, Illinois, USA (23 Sep 1975).

The groundwater monitoring program provides information and data on groundwater quality required to evaluate the impact of waste disposal practices on the Hanford Reservation. The program includes: collection and analysis of groundwater samples on a routine basis; data processing, analysis and reporting; design, construction and maintenance of well sampling structures; and design and implementation of supporting research studies. Within the overall framework of the Groundwater Monitoring Program, the 300 Area and Wye Burial Ground Characterization Program was initiated to evaluate transport of radionuclides in the partially saturated zone above the water table and to provide site characterization at solid waste burial locations on the Reservation. Methods for collecting and analyzing program data include geophysical exploration by ground penetrating radar, refraction and reflection acoustics, magnetics, and metal detection; stratigraphic investigations by drilling and sample collection techniques; evaluation of transport phenomena by in situ psychrometric and gamma-neutron techniques; laboratory characterization of fluid and vapor transport-controlling mechanisms; and evaluation of biological radionuclide transport by organisms inhabiting contaminated areas. (auth)

7283 (BNWL-SA-5494(Pt.2)) MONITORING AND CHARACTERIZATION OF RADIONUCLIDE TRANSPORT IN THE HYDROGEOLOGIC SYSTEM. Phillips, S. J.; Raymond, J. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 84p. (CONF-750967-16). Dep. NTIS $5.00.

From 3rd ERDA environmental protection conference; Chicago, Illinois, USA (23 Sep 1975).

Historical records pertaining to the 300 North and Wye Burial Grounds at the Hanford Reservation were reviewed as a prerequisite to determining programs for land reclamation. All available historical documents, agency communications, and engineering drawings related to the study areas were located, reviewed, and analyzed. An inventory of recorded location, type, and quantity of radionuclides and associated materials in each burial ground was completed and distributed to cooperating investigators. A geophysical survey of the 300 North Burial Ground was conducted as a basis for detecting the composition, size, distribution, and depth of buried objects and characterizing the sediments in which they are buried. Acoustic, radar, magnetic, and metal detection surveys were completed and their applicability evaluated; drilling techniques and equipment for recovering and characterizing sediments and radioactive contaminated material were developed. Drilling will also determine the amount and dimensional extent of radionuclide migration; sediment-fluid interaction and fluid migration through the unsaturated zone at the 300 North Burial Ground were characterized. A study to determine biological transport of radionuclides at the Wye Burial Ground was also initiated. This study involved a preliminary survey of present flora and fauna inhabiting the Wye Burial Ground site. Plant tissue was chemically and radiochemically analyzed to determine radionuclide migration and possible dose effects and population dynamics of burrowing animals that could potentially be exposed to buried waste materials were investigated. (CH)

7284 (CONF-751105-4) PHYSICAL AND CHEMICAL CHARACTERISTICS OF PLUTONIUM IN EXISTING CONTAMINATED SOILS AND SEDIMENTS. Tamura, T. (Oak Ridge National Lab., Tenn. (USA)). 1975. 19p. (SM-199/52). Dep. NTIS $4.00.

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, California, USA (17 Nov 1975).

Plutonium from three sites was studied to provide information necessary in understanding its behavior and fate under prevailing conditions. Plutonium in soils from the Nevada Test Site (NTS) was predominantly associated (50 to 75 percent) with the coarse silt (53 to 20 mu m) fraction. The plutonium in samples from Oak Ridge National Laboratory (ORNL) and Mound Laboratory (ML) was predominantly in the clay size (less than 2 mu m). The solubility in citric acid was about 20 to 25 percent in the ORNL sample and 40 to 50 percent in the ML sample. Density gradient segregation of the clay size fraction of the ML sample showed the activity distribution to be directly related to the weight of the recovered fraction with enhanced contribution by the very light organic fraction. Approximately 71 percent was found in the 2.3 to 2.4 g/cm^3 fraction which contained 65 weight percent of the clay and 16 percent in the less than 1.8 g/cm^3 fraction (organic fraction) which contained 6 percent of the weight fraction. (auth)

7285 (HW-47152) RADIATION ASPECTS FOR RIVER NAVIGATION THRCUGH HANFORD PROJECT. Clukey, H. V. (General Electric Co., Richland, Wash. (USA). Hanford Atomic Products Operation). 7 Dec 1956. 8p. Dep. NTIS $4.50.

Declassified 9 Dec 1970.

The reach of the Columbia River through the Hanford project could be reopened to commercial navigation and limited public recreational activities, so far as radiation protection aspects shown by an initial study made in 1956 are concerned. (auth)

7286 WORLD PATTERN OF OXYGEN-18 IN RAINWATER AND ITS IMPORTANCE IN UNDERSTANDING THE BIOGEOCHEMICAL OXYGEN CYCLE. Foerstel, H. (Nuclear Research Center, Juelich, Ger.); Putral, A.; Schleser, G.; Lieth, H. pp 3-20 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The oxygen-18 content of precipitation is the basic value for studies on photosynthetic oxygen and the water economy of plant communities using naturally occurring isotopic fractionations. Thus a world-wide pattern of the $H_2{}^{18}O$ content of rainwater is necessary. This pattern can be deduced with the help of the two-dimensional interpolation program SYMAP. To produce world-wide maps the available number of stations is normally not sufficient. The authors have attempted to obtain a more detailed pattern by a simple correlation study. The map was interpreted with the help of an auxiliary program which computes latitude zonal averages (MAPCOUNT). The latitude histogram can be correlated with other information such as the productivity. The importance of a global program like SYMAP was demonstrated with the help of the $H_2{}^{18}O$ variation in precipitation. (auth)

7287 ISOTOPIC RATIOS OF IODINE AND OTHER RADIONUCLIDES AS NUCLEAR POWER POLLUTION INDICATORS. Brauer, F. P.; Ballou, N. E. (Battelle-Pacific Northwest Labs., Richland, WA). pp 215-229 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The determination of isotope ratios in addition to radionuclide concentrations is useful in the identification and tracing of radioactive pollutant sources. Methods have been developed for measurement of $^{58}Co/^{60}Co$, $^{134}Cs/^{137}Cs$, $^{129}I/^{127}I$ and other radionuclide effluent isotope ratios at levels much below those required for radiation protection. Measurements of $^{58}Co/^{60}Co$, $^{134}Cs/^{137}Cs$, $^{135}Cs/^{137}Cs$ and $^{129}I/^{127}I$ in environmental samples have demonstrated their application to the detection of nuclear plant effluents. Increased $^{129}I/^{127}I$ ratios were observed in nuclear fuel separations facility environs at levels much below radiation protection standards. The pathways in the transfer of atmospheric ^{129}I to food materials has been studied by means of $^{129}I/^{127}I$ analyses of environmental samples. Vegetation absorption of atmospheric iodine was found to be significant. The $^{129}I/^{127}I$ ratio was observed to decrease in the pathway from the atmosphere to food. Examples of the use of ^{129}I analysis for environmental studies are presented. (auth)

7288 DEISTVIE IONIZIRUYUSHCHIKH IZLUCHENII NA EKLOGICHESKIE SISTEMY. (Effect of Ionizing Radiation on Ecological Systems). Tikhomirov, F. A. Moscow; Atomizdat (1972). 176p.

This monograph generalizes features of studies on radioactive contamination of the plant cover and the effects of ionizing radiation on organisms, populations and communities under natural conditions. A look is taken at sources of radioactive contamination of the biosphere, and a description is given of the regularities in the fallout of radioactive fission products which are formed during nuclear explosions, the interaction of the fission products with the plant cover, and their subsequent migration. A summary is presented of data on the radiosensitivity of terrestrial plants and animals, and the reasons for the observed wide variations in radiosensitivity are discussed. An analysis is presented of the disruptions in a community caused by irradiation. A detailed description is given of the consequences caused directly by irradiation (primary effects) and those caused by disruptions of biocenotic relationships in irradiated systems (secondary effects). Significant attention is devoted to describing and analyzing phenomena occurring on irradiating a forest with various sources of ionizing radiation. A look is taken at the possibility of re-establishing irradiated forest stands. 17 tables, 15 figures, 315 refs. (SJR)

Atmosphere

Refer also to abstracts 7346, 8246, and 8247.

7289 (BNWL-SA-5355) INTERPRETATION OF NEAR-BACKGROUND ENVIRONMENTAL SURVEILLANCE DATA BY DISTRIBUTION ANALYSIS. Waite, D. A.; Bramson, P. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 23p. Dep. NTIS $4.50.

Large numbers of radionuclide/medium combinations exhibit log-normal distributed environmental concentrations when these are plotted for a location over time or for one time over many locations. That is, environmental data are distributed such that they yield a straight line when plotted on log-probability paper. Although the log-normal distribution has not been applied on a wide scale to radiological data, and does not seem to describe all nuclide-medium combinations, its usefulness for predicting the levels of radionuclides in the environs and in human diets is discussed. Because the data are presented graphically, the mean, standard deviation, expected upper limits, and any plant contribution can be readily determined visually. Quoting with confidence a geometric mean of value less than minimum detectable level is uniquely possible by means of distribution analyses and overcomes the divisive problem of how to deal with such results. Mathematical data transformation techniques that have been devised for investigating characteristics of data sets are described. (CH)

7290 (BNWL-SA-5482) STATISTICAL DISTRIBUTIONS AS APPLIED TO ENVIRONMENTAL SURVEILLANCE DATA. Speer, D. R.; Waite, D. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1975. Contract E(45-1)-1830. 30p. (CONF-750967-19). Dep. NTIS $5.00.

From 3rd ERDA environmental protection conference; Chicago, Illinois, USA (23 Sep 1975).

Application of normal, log normal, and Weibull distributions to environmental surveillance data was investigated for approximately 300 nuclide-medium-year-location combinations. Corresponding W test calculations were made to determine the probability of a particular data set falling within the distribution of interest. Conclusions are drawn as to the fit of any data group to the various distributions. The significance of fitting statistical distributions to the data is discussed. (auth)

7291 (ERDA-1540) BROOKHAVEN NATIONAL LABORATORY ENVIRONMENTAL STATEMENT. (Brookhaven National Lab., Upton, N.Y. (USA)). Nov 1975. vp. Office of the Assistant Administrator, Washington, D.C.

Background radiation levels have been measured continuously at BNL with respect to external gamma exposure and activity levels in air, water, soil, grass, and milk. The amounts of radioactivity and other potential environmental contaminants in BNL effluents, as well as external radiation levels attributable to BNL sources, are measured, and an extensive environmental monitoring and sampling program is conducted to ascertain the increments, if any, within the regional ecological system of pollutants attributable to BNL effluents. The principal pathways of radiation exposure to man from BNL operations involve releases of waste to the atmosphere and the Peconic River and direct radiation both from experimental facilities and transportation of waste materials. The resulting whole-body dose to the population within 50 miles of the BNL site in 1973 was 0.001 percent of the dose received from natural background radiation, and the exposures to biota were similarly insignificant. Routine chemical releases to the atmosphere, the Peconic River, and the ground produce no perceptible impact on humans or biota; all such releases are well below applicable standard limits for off-site areas. Alterations of the physical environment by the addition of heat or nonionizing radiation resulting from BNL operations have had no measurable impact on humans or other biota. The accumulation of radioactive emissions from BNL and other existing and planned nuclear facilities within a 50-mile radius is small. Nonradioactive releases from BNL represent a small percentage of those from other sources in the region. Many BNL facilities use or generate materials that could produce environmental damage if released in an uncontrolled fashion. In the worst possible case, the resulting whole-body dose to the population within a 50-mile radius would be 0.166 percent of that received from natural background. (ERB)

7292 (HASL-297) HEALTH AND SAFETY LABORATORY ENVIRONMENTAL QUARTERLY, JUNE 1, 1975–SEPTEMBER 1, 1975. Hardy, E. P. Jr. (USAEC Health and Safety Lab., New York). 1 Oct 1975. 188p. Dep. NTIS $7.60.

This report presents current data from the HASL environmental programs, The Institute of Nuclear Science in Taiwan, and the Australian Radiation Laboratory. The initial section consists of interpretive reports and notes on global ^{90}Sr fallout in 1974, ^{90}Sr in human bone in 1974, and the HASL Regional Baseline Station at Lloyd, N. Y. Subsequent sections include tabulations of radionuclide levels in stratospheric air, surface air, deposition, milk, diet, tapwater, and human bone. A bibliography of recent publications related to environmental studies is also presented. (auth)

7293 (HASL-297(App.)) HEALTH AND SAFETY LABORATORY ENVIRONMENTAL QUARTERLY, JUNE 1–SEPTEMBER 1, 1975. (USAEC Health and Safety Lab., New York). 1 Oct 1975. 512p. Dep. NTIS $10.60.

Data are presented on the activity from fallout ^{90}Sr and ^{89}Sr in precipitation sampled at various world land sites during 1975; the gross gamma activity in samples of surface air collected at various locations; the content of stable Pb in samples of surface air; and the content of ^{89}Sr and ^{90}Sr in samples of milk and drinking water collected in North, Central, and South America. (CH)

7294 RADIOACTIVE CONTAMINATION OF THE ENVIRONMENT AND THE POSSIBLE CONSEQUENCES. Knizhnikov, V. A.; Barkhudarov, R. M. (Inst. of Biophysics, Moscow). At. Energy Rev.; 13: No. 2, 171-183(Jun 1975).

To find the optimum solution to the problem of how to protect the environment from pollution by industrial waste, it is necessary, first and foremost, to obtain information on the existing levels of various forms of pollution and the damage caused by them. In this review data are given on all the main sources of contamination of the environment by radioactive substances. The pathways by which these substances reach and affect the human body are discussed, the doses incurred are characterized and the possible consequences of existing levels of exposure are assessed in the light of the latest data on the dose-effect relationship. The wisdom of treating the evaluation of radiation hazards arising from the use of atomic energy not in isolation but as part of a whole complex of ecological factors including the use of conventional fuels for power generation and transport is duly noted. (auth)

7295 ANTHROPOGENIC CARBON-13 DECREASE IN ATMOSPHERIC CARBON DIOXIDE AS RECORDED IN MODERN WOOD. Freyer, H. D.; Weisberg, L. (Nuclear Research Center, Juelich, Ger.). pp 49-62 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The increase of CO_2 in the atmosphere due to human activities is investigated by means of the stable carbon isotope record in modern wood. This is possible, because fossil fuels are labelled rather uniformly by a ^{13}C-deficit of about 18 percent relative to atmospheric CO_2. For the isotopic analysis cellulose was isolated from wood. Each sample, representing a five-year average, was measured after burning to CO_2 by means of mass spectrometry. Difficulties arise mainly from two sources: first, growth conditions are probably superimposed upon the expected trend, especially in the first years of the tree; and second, an isotopic exchange between atmospheric CO_2 and other geological carbon reservoirs may occur without any net flux. A regression curve, calculated for the last 60 years of an average of several free-standing trees, shows a delta ^{13}C decrease of only 0.3‰. This does not mean, however, that the CO_2 excess in the atmosphere is only 12 percent of the man-made carbon dioxide, because the exchange of CO_2 with marine bicarbonate lowers the delta ^{13}C labelling. Using a simple two-box model, consisting of atmosphere and ocean, a value of 30 percent for the excess CO_2 still present becomes more likely corresponding to an average residence time of of 3.4 years for a CO_2 molecule in the atmosphere. (auth)

7296 METHOD OF DETERMINATION OF SOURCE CONTRIBUTION TO RADIOACTIVE CONTAMINATION OF THE ATMOSPHERE. Semova, R. V.; Ternovskii, I. A.; Tret'yakova, A. F. (Inst. of Atomic Energy, Moscow). pp 211-214 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975). (In Russian).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Gamma-spectrometric measurements of activity ratios of radionuclides in soil, atmosphere and gaseous wastes allow the source contribution to the radioactive contamination of the atmosphere to be determined rapidly and reliably. (auth)

7297 RELEASES OF KRYPTON-85 AND TRITIUM TO THE ENVIRONMENT AND TRITIUM TO KRYPTON-85 RATIOS AS SOURCE INDICATORS. Schroeder, K. J. P.; Roether, W. (Univ., Heidelberg). pp 231-253 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

More than 95 percent of the krypton-85 that is at present observed in the environment on a global scale originates from the combined releases following nuclear-power generation and plutonium production, while atmospheric fusion-bomb testing accounts for the same percentage of the global tritium. The global inventories at the end of 1973 were 55 MCi (estimated uncertainty +- 10 percent) of krypton-85, and 2900 MCi (+- 25 percent) of tritium. From the excess of the global krypton-85 inventory over the amounts accounted for by the sources other than plutonium production, it is concluded that 130 tonnes of plutonium-239 have been produced up to 1970. Pronounced fractionation occurs between atmosphere and hydrosphere, in the sense that the concentration of krypton-85 is lowered, and that of tritium (being overwhelmingly in the form of a water molecule, HTO) is greatly increased, in the hydrosphere. Largely as a consequence of this fractionation, the environmental tritium to krypton-85 ratios cover a wide range, with values lowest in the troposphere (typical order of magnitude 10^{-1} Ci/Ci) and highest in continental surface water (approximately 10^{5}). Preliminary oceanic krypton-85 data are reported, which indicate that the concentration decrease with depth in the ocean is very similar for both nuclides. Effluents from nuclear power reactors and reprocessing plants have tritium to krypton-85 ratios that do not differ markedly from those found at present in the troposphere; on the other hand, the very high ratios that are typical of the hydrosphere may offer opportunities of detecting such effluents in the hydrosphere on the basis of tritium to krypton-85 ratios. Considerable uncertainties in the ratios of the effluents have, however, to be anticipated, arising from varying, and fluctuating, fractionation between the two nuclides in the release processes. (auth)

7298 ENVIRONMENTAL MONITORING. Thompson, I. M. G. (Central Electricity Generating Board, Berkeley, Eng.). J. Inst. Nucl. Eng.; 16: No. 3, 67-71(May 1975).

The Central Electricity Generating Board (CEGB) environmental monitoring programme associated with the operation of Magnox nuclear power stations is described. The monitoring programme may be divided into two parts, one part dealing with the routine programme and the other with emergency procedures, and both parts are further subdivided into pre-operational and operational phases. It is considered that, apart from a few changes, the Magnox monitoring programme will be applicable to the Advanced Gas Cooled stations (AGRs). (UK)

Soil

7299 RADIOISOTOPE RATIOS IN CHARACTERIZING THE MOVEMENT OF DIFFERENT PHYSICAL AND CHEMICAL SPECIES THROUGH NATURAL SOILS. Robertson, D. E.; Perkins, R. W. (Battelle-Pacific Northwest Labs., Richland, WA). pp 123-131 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Physiochemical characterization studies of reactor effluent water radionuclides at the Hanford N-Reactor are providing important information describing the mobility of radionuclides in freshwater environments. At N-Reactor, cooling water containing a wide spectrum of radionuclides in various physicochemical forms is discharged to a seepage trench located near the reactor. The effluent water migrates through a soil bank between the trench and the Columbia River, and a portion of the water emerges as seepage springs along the bank of the Columbia River near the reactor. The mobility of effluent water radionuclides during transport through the soil is greatly dependent upon the physicochemical forms of the radionuclides. Radionuclides in particulate and cationic forms are nearly quantitatively retained in the soil bank by sorption onto mineral phases; whereas, radionuclides in anionic and soluble nonionic forms are relatively mobile and are retained by the soil to a much lesser degree. Several radionuclides such as ^{60}Co, $^{103-106}Ru$ and $^{122-124-125}Sb$ are present in reactor effluent water partitioned among particulate, cationic, anionic and non-ionic species. However, as these radionuclides migrate through the soil bank their particulate and cationic forms are retained, and predominantly anionic and nonionic forms emerged in the seepage springs. Studies of the behaviour of these radionuclides are providing data for assessing present rad-waste treatment processes and in improving future processes for reducing environmental releases of radionuclides from nuclear installations. (auth)

Water

Refer also to abstract 7333.

7300 (UCRL-51913(Pt.1)) RADIOLOGICAL AND CHEMICAL STUDIES OF THE GROUND WATER AT ENEWETAK ATOLL. 1. Sampling, Field Measurements, and Analytical Methods. Marsh, K. V.; Wong, K. M.; Holladay, G.; Noshkin, V. E.; Buddemeier, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.; Hawaii Univ., Honolulu (USA)). 26 Sep 1975. Contract W-7405-Eng-48. 28p. Dep. NTIS $4.00.

A research program to study the groundwater on several of the islets in the Enewetak Atoll is being conducted jointly by Lawrence Livermore Laboratory and the University of Hawaii under the sponsorship of ERDA Division of Biology and Environmental Research. The purpose is to provide data characterizing the ground water for possible use by returning Marshallese and to investigate the hydrology and recycling of radionuclides in an atoll environment. This first of a series of reports describes the sampling locations, field operations, and methods of analysis. (auth)

7301 CORRELATION OF NUCLEAR-WEAPON PRODUCED C-14 AND TRITIUM IN THE NORTH ATLANTIC OCEAN. Roether, W. Heidelberg; Heidelberg Univ. (1972). 42p. (In German). INIS.

Thesis.

A combined use was made of ^{14}C and T in near-surface layers to study horizontal exchange in the surface water and the vertical mixture, and correction on nuclear-weapons produced ^{14}C at measured ^{14}C concentrations in intermediary and deep water. Nuclear-weapons-produced ^{14}C and T both show a time-dependent distribution in the ocean and thus contrast with most of the other trace materials which might come into question for oceanic investigations. Furthermore, it is significant that the time dependences for ^{14}C and T are clearly different. (GE)

7302 ANOMALOUS BEHAVIOR OF THORIUM AND URANIUM ISOTOPES IN THE MARINE ENVIRONMENT OF THE WEST COAST OF INDIA. Joshi, L. U.; Ganguly, A. K. (Bhabha Atomic Research Center, Trombay, India). pp 169-178 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Geochemical behavior of thorium and uranium isotopes and their activity ratios have been studied in the coastal marine sediments of the West Coast region of the Indian sub-continent. These coastal regions offer a unique advantage for studying the geochemistry and

transport of natural radioactivity. The results of this study can be correlated with the transport and deposition of artificially introduced radioactivity or any run-off terrestrial pollutants in the region. In the southern part of the West Coast there are extensive placer deposits containing thorium- and uranium-bearing minerals (monazite) whereas the northern part is relatively free of such deposits. The surface layers of the coastal sediments are leached with 5 percent EDTA for the extraction of thorium and the saturated solution of ammonium carbonate for the extraction of uranium. The leaching agents are so chosen that they have high efficiency for leaching thorium and uranium and at the same time do not in any way attack the mineral core of the sediment particles. The thorium and uranium isotopic activities and the ratios $^{228}Th/^{232}Th$, $^{230}Th/^{232}Th$, $^{234}U/^{238}U$ and $^{235}U/^{238}U$ are calculated. The $^{228}Th/^{232}Th$ activity ratios in the Bombay region and in the Monazite areas are in the range 0.55 to 0.67 while the ratios in the region between Ratnagiri and Honawar are in the range 2.00 to 2.19. The $^{230}Th/^{232}Th$ activity ratios are in the range 0.13 to 0.15 in the Bombay region, 0.95 to 1.07 in the region between Ratnagiri and Honawar and 0.23 to 0.25 in the monazite areas. However, such large variations are not observed in $^{234}U/^{238}U$ activity ratios. The $^{234}U/^{238}U$ activity ratios are in the range 1.12 to 1.14 in the coastal sediments from the regions between Bombay and Kottilppad. The activity ratios $^{234}U/^{238}U$ in coastal sea-water are in the range 1.15 to 1.16. The $^{235}U/^{238}U$ activity ratios in sediments and sea-water are 0.046, which is the same as that of natural uranium. (auth)

Ecosystems and Food Cycles

Refer also to abstract 7617.

7303 (BNWL-SA-5416) FIXATION AND LONG-TERM ACCUMULATION OF TRITIUM FROM TRITIATED WATER IN AN EXPERIMENTAL AQUATIC ENVIRONMENT. Strand, J. A.; Templeton, W. L.; Olson, P. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 24p. (CONF-751026-31). Dep. NTIS $4.50.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (1 Oct 1975).

The accumulation of tritium in selected freshwater biota was studied in a 10 m diameter concrete-lined pond at the Hanford Atomic Energy Works. Tritium as tritiated water was introduced for 8 months continuously in the replacement water at a concentration of mu Ci per liter; and water, biota (carp, clams, crayfish, periphyton, pondweed), and sediments were sampled on a predetermined schedule. The pond was maintained on uncontaminated replacement waters for an additional 8 months to determine the rate of elimination from the ecosystem. After the first day, tissue-free-water tritium in all biota approached an equilibrium with pond water. Final concentration factors of 0.89, 0.87, 0.82, 0.92, 0.77, 0.88 were calculated for carp, clam, crayfish, snail, periphyton, and pondweed. Although highly variable, analyses of pond sediments suggested an initial rapid uptake by the loose water fraction, attaining 0.30 of the pond equilibrium level in three days. There was evidence to suggest a secondary slower rate of uptake that accounted for 0.65 of the pond equilibrium level as determined at seven months. Tissue-bond tritium initially increased rapidly in all biota sampled, but slowed with time. Equilibrium conditions were not reached. Final concentration factors for carp, clam, crayfish, snail, periphyton, and pondweed were calculated to be 0.49, 0.10, 0.53, 0.54, 0.15, and 0.62. Analyses of sediments after removal of the loose water fraction revealed little or no organically bound tritium. (auth)

7304 (COO-3011-5) OCCURRENCE OF ^{137}C IN THE BIOSPHERE EVALUATED WITH ENVIRONMENTAL AND METABOLIC STUDIES. Haesaenen, E. (Helsinki Univ. (Finland). Dept. of Radiochemistry). May 1972. Contract E(11-1)-3011. 119p. Dep. NTIS $6.50.

This work forms a part of the fall-out studies carried out in the Department of Radiochemistry, University of Helsinki. Its main emphasis has been on the gamma-spectrometric determination of the ^{137}Cs-levels and changes herein in different environmental samples and in man after the second nuclear testing period in 1961–1962. Special attention has been paid to the aquatic food-chains of ^{137}Cs, to the foodchain reindeer-lichen-man, and to the biological half-life of ^{137}Cs in man and in certain fish species. (auth)

Radiometric Techniques

Refer also to abstracts 7276 and 7352.

7305 (CENA-BC-016) GENERALIZATION OF SOIL-WATER MOVEMENT. 1. Horizontal Infiltration. Libardi, P. L.; Reichardt, K. (Centro de Energia Nuclear na Agricultura, Piracicaba (Brazil)). Mar 1974. 29p. (In Portuguese). INIS.

The process of infiltration of water into soils is studied with the objective of finding general soil water movement equations that would describe the process in different soils. With the aid of a generalization constant and of dimensionless variables the generalization was possible for horizontal infiltration. Five soils of the State of Sao Paulo have been used. Generalized hydraulic conductivity and soil-water diffusivity data are presented. The possibility of estimation of these hydraulic characteristics for other mineral soils is also shown. Measurements of water contents and bulk densities have been made by gamma-ray attenuation. (INIS)

7306 (CONF-731201-) ADVANCED CONCEPTS AND TECHNIQUES IN THE STUDY OF SNOW AND ICE RESOURCES. An Interdisciplinary Symposium Held at Monterey, California, December 2–6, 1973. Santeford, H. S.; Smith, J. L. (comps.). (National Academy of Sciences, Washington, D. C. (USA)). 1974. 789p. National Academy of Sciences, Washington, DC $11.00.

Separate abstracts were prepared for eight papers. (CH)

For abstracts of individual papers see: 7307–7314.

7307 (CONF-731201-, pp 579-593) EXPERIMENTAL GAMMA-RAY SPECTROMETER SNOW SURVEY OVER SOUTHERN ONTARIO. Grasty, R. L. (Geological Survey of Canada, Ottawa); Loijens, H. S.; Ferguson, H. L. 1974.

From symposium on advanced concepts and techniques in the study of snow and ice resources; Monterey, California, USA (2 Dec 1973).

In advanced concepts and techniques in the study of snow and ice resources. ((National Academy of Sciences, Washington, D.C. (USA)).

In the winter of 1972–1973, four gamma-ray spectrometer surveys, each 1850 km long, were flown over Southern Ontario at 150 m, using a 50,000 cm^3 sodium iodide detector system. Total radioactivity and potassium information was used to calculate a snow-water equivalent for 16 km sections along each flight line. The airborne results are compared with ground data from 10 snow courses established along the flight lines. A root mean square deviation of 1.2 cm water equivalent was found between the ground and potassium-airborne results, whereas a deviation of 1.7 cm water equivalent was calculated between data from the ground and those from the total radioactivity information. Soil moisture corrections from measurements at selected sites were found to decrease the calculated snow-water equivalent an average of 1.7 cm. Errors in the soil moisture measurements and background variations encountered along the flight lines were found to be more important than statistical errors. (auth)

7308 (CONF-731201-, pp 594-603) AREAL SNOWPACK WATER-EQUIVALENT DETERMINATIONS USING AIRBORNE MEASUREMENTS OF PASSIVE TERRESTRIAL GAMMA RADIATION. Jones, E. B.; Fritzsche, A. E.; Burson, Z. G.; Burge, D. L. (EG and G, Inc., Las Vegas, NV). 1974.

From symposium on advanced concepts and techniques in the study of snow and ice resources; Monterey, California, USA (2 Dec 1973).

In advanced concepts and techniques in the study of snow and ice resources. (National Academy of Sciences, Washington, D.C. (USA)).

Airborne measurement of the areal average of the water equivalent of snow by the terrestrial gamma attenuation method is accurate to 1.2 cm or 10 percent whichever is greater. Airborne survey data from study areas in the midwest show that airborne radon daughters, soil moisture, and gamma counting statistics are the predominant sources of error. The method has good potential for large, rapid areal measurements of water equivalent over flat or rolling terrain. (auth)

7309 (CONF-731201-, pp 604-613) MEASUREMENT OF SNOW AT A REMOTE SITE: NATURAL RADIOACTIVITY TECHNIQUE. Bissell, V. C.; Peck, E. L. (National Weather Service, Silver Spring, MD). 1974.

From symposium on advanced concepts and techniques in the study of snow and ice resources; Monterey, California, USA (2 Dec 1973).

In advanced concepts and techniques in the study of snow and ice resources. (National Academy of Sciences, Washington, D.C. (USA)).

The use of natural gamma radiation from the soil as a basis for snow water equivalent measurements at remote sites has been under investigation by the National Weather Service since 1970. Results to date indicate that measurements with about five percent error in the five to forty centimeter water equivalent range can be obtained in periods uncomplicated by precipitation or considerable change in soil moisture. Periods of active melt can be subject to

serious errors. A new natural radioactivity method is also proposed. The use of highly penetrating cosmic radiation appears to have excellent potential for point snow water equivalent measurement in extremely deep snow. (auth)

7310 (CONF-731201-, pp 614-623) NATURAL GAMMA SPECTRAL PEAK METHOD FOR SNOW MEASUREMENT FROM AIRCRAFT. Bissell, V. C. (National Weather Service, Silver Spring, MD). 1974.

From symposium on advanced concepts and techniques in the study of snow and ice resources; Monterey, California, USA (2 Dec 1973).

In advanced concepts and techniques in the study of snow and ice resources. (National Academy of Sciences, Washington, D.C. (USA)).

The accuracy of airborne measurements of snow water equivalent over large areas using the ^{40}K gamma radiation spectral peak is limited both by the accuracy of soil moisture estimates and by variation in general radon distributions between missions. The accuracy of the ^{208}Tl spectral peak method is constrained only by soil moisture estimate accuracy and is therefore preferred over large areas. The use of an optimal linear combination of the ^{40}K and ^{208}Tl method water equivalent measurements significantly improves accuracy over small basins where only one or two flights are made. To complement current literature on gamma snow surveys, dynamic aspects of radon in both soil and atmosphere are reviewed. (auth)

7311 (CONF-731201-, pp 624-631) UTILITY OF ISOTOPE PROFILING SNOW GAGE FOR WATER MANAGEMENT. Limpert, F. A. (Bonneville Power Administration, Portland, OR); Smith, J. L. 1974.

From symposium on advanced concepts and techniques in the study of snow and ice resources; Monterey, California, USA (2 Dec 1973).

In advanced concepts and techniques in the study of snow and ice resources. (National Academy of Sciences, Washington, D.C. (USA)).

The electric power needs of the Pacific Northwest at the present time are satisfied primarily by hydropower projects. Three basic ingredients are embodied in a determination of the hydroelectric power potential of a river basin: streamflow and associated head, storage, and power plant installation. The broad storage component is examined in some detail. Storage is generally viewed as water in a reservoir behind a dam; however, the groundwater pool and the snowpack are also a part of the storage component. Reservoirs can be controlled, and to a much lesser degree so can the groundwater component; but except for some very specialized situations, there is virtually no control over the snow component of storage. The snow component amounts to nearly ¾ of the average runoff of the Columbia River. Experience to date with the isotope profiling snow gage indicates this instrument will be a valuable adjunct to the hydrometeorological network. The profiler system, a method for translating field measurement data to management use, and existing and proposed utilization of the profiler data for management purposes, are described. (auth)

7312 (CONF-731201-, pp 632-641) NUCLEAR TECHNIQUES FOR SNOW AND ICE STUDIES IN CANADIAN SUBPOLAR REGIONS (DEVON ISLAND). Prantl, F. A. (Canada Centre for Inland Waters, Burlington, Ont.); Koerner, R. M.; Robertson, E. 1974.

From symposium on advanced concepts and techniques in the study of snow and ice resources; Monterey, California, USA (2 Dec 1973).

In advanced concepts and techniques in the study of snow and ice resources. (National Academy of Sciences, Washington, D.C. (USA)).

In a cooperative multidisciplinary program, snow and ice samples have been collected on a traverse from the south-east to the north-west across Devon Island, North-West Territories, Canada, and analyzed for stable and radioactive isotopes: deuterium, oxygen-18, tritium, and total beta-activities originating from fission product debris of atmospheric nuclear weapons testing. The snow samples consisted generally of one annual layer. The ice under the annual snow cover was sampled, and additionally samples were taken from pits at various locations, comprising up to three annual layers of net accumulation. The purpose of the study is to demonstrate to what extent it is possible by use of nuclear methods in Canadian subpolar regions under melting and drifting conditions to identify origin and seasonal patterns of snow deposits, date the layers, and determine the net accumulation rates for mass balance studies. (auth)

7313 (CONF-731201-, pp 642-650) USE OF THERMOLUMINESCENT DOSIMETERS FOR STUDIES OF THE SNOW COVER. Grummitt, W. E.; Prantl, F. A. (Atomic Energy of Canada Ltd., Chalk River, Ont.). 1974.

From symposium on advanced concepts and techniques in the study of snow and ice resources; Monterey, California, USA (2 Dec 1973).

In advanced concepts and techniques in the study of snow and ice resources. (National Academy of Sciences, Washington, D.C. (USA)).

A preliminary study has shown the feasibility of using thermoluminescent dosimeters (TLD's) to determine the water equivalent of the snow cover by gamma ray attenuation measurements. Small lithium fluoride detectors were placed at a convenient height of 1 to 2 metres above ground at the beginning of the observation period and collected afterwards to be read in the laboratory. Attenuation studies of gamma-radiation from point sources and natural background were carried out. The latter require TLD exposure times of several weeks. Point sources of 10 to 500 mu Ci located at ground level allow much shorter exposure times. In general the source strength is chosen according to height of snow cover and length of observation period. Advantages of this system are cheapness, flexibility, easy monitoring, simple field installation. Therefore it can serve a large number of observation stations. (auth)

7314 (CONF-731201-, pp 661-675) DEVELOPMENT AND FIELD TESTING OF A REMOTE RADIOISOTOPIC SNOW GAGE. Shreve, D. C. (JRB Inc., La Jolla, CA); Brown, A. J. 1974.

From symposium on advanced concepts and techniques in the study of snow and ice resources; Monterey, California, USA (2 Dec 1973).

In advanced concepts and techniques in the study of snow and ice resources. (National Academy of Sciences, Washington, D.C. (USA)).

In stream runoff forecasting and flood prediction it is necessary to have timely information about the water stored in the high mountain snowpacks. In addition to the total water equivalent, it may be useful to have information about the nature and conditions of the snowpack. Dry snow, for example, will absorb significant amounts of water before runoff begins, whereas wet snow will allow additional water to drain. Present methods of remotely measuring the water equivalent of the snowpack rely on pressure measuring devices located at or below ground level. These devices give a measurement of the total water equivalent in the snow above the device but not its condition. The development of a radioisotopic profiling gage has shown that detailed information about the location of the water throughout the snowpack could be obtained by measuring the attenuation of gamma radiation passing through the snow. Research scientists are now studying the physics of snow using such gages. A simpler radioisotopic snow gage which provides information intermediate between the pressure device and the profiling gage has been developed and has undergone field tests conducted by the State of California Department of Water Resources at their developmental test station. The gage provides the water equivalent of the snowpack in each of ten vertical increments. Both a total water equivalent and a course vertical density distribution of the snowpack are obtained. Design data are included. (CH)

7315 (GSF-R-81) APPLICATION OF RADIONUCLIDES IN HYDROLOGY. Lorch, S.; Moser, H.; Neumaier, F.; Rauert, W.; Wendt, I. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Radiohydrometrie). [nd]. 40p. (In German). INIS.

48 figs.; 2 tabs.; 10 refs. Available from ZAED.

After an historical review and some remarks on radionuclide physics and measuring techniques with a list of some of the radionuclides used in hydrology and their data relevant to radiation protection as well as of some neutron sources, the application of radioactive tracer materials in ground water hydrology, the use of radionuclides in the determination of the density and the water content of the ground, and the isotope ground water dating method are treated. (GE)

7316 (N-75-19752) TABLES FOR DETERMINING LEAD, URANIUM, AND THORIUM ISOTOPE AGES. Schonfeld, E. (National Aeronautics and Space Administration, Houston, Tex. (USA). Lyndon B. Johnson Space Center). Dec 1974. 35p. (NASA-TM-X-58145). NTIS $3.75.

Tables for determining lead, uranium, and thorium isotope ages are presented in the form of computer printouts. Decay constants, analytical expressions for the functions evaluated, and the precision of the calculations are briefly discussed. (STAR)

7317 CONTRIBUTION TO THE ISOTOPIC GEOCHEMISTRY OF CARBON IN MAGMATIC ROCKS. Hoefs, J. Goettingen, Ger.; Goettingen Univ. (1973). 55p. (In German). INIS.

Thesis.

A review is given of the isotope composition of the carboniferous components in magmatic rocks. All magmatic rocks,

independent of the type of rock, contain carbon in trace amounts in at least two different oxidation forms, carbonate and CO_2 in liquid and gaseous mineral enclosures, and in a reduced form. It can be concluded from a balance calculation and from the average $^{13}C/^{12}C$ ratio of the carbonatites and diamonds that the average C isotope composition of the crust must be between 7 and 8‰ relative to the international standard PDB. The carbonate carbon exhibits a very variable isotope composition (delta ^{13}C values between −0.5 and −24.8‰; delta ^{18}O values between 3.0 and −14.7) whereas the reduced carbon shows a relatively constant isotope ratio with "light" delta ^{13}C values between −23.8 and −28.9‰. To supplement the measured isotope values, a few volcanic CO_2 samples were analyzed. Whereas, "light" delta ^{13}C values between −15 and −25‰ were found in the cases where it was possible to capture directly released CO_2 from hot magma (Hawaii, crackling salt in the vicinity of basaltic passages), the CO_2 released in the various types of volcanic gas-expelling phenomena such as hot sources, fumaroles, mofettes, etc., showed a different isotope composition with delta ^{13}C values which were generally between −2 and −5‰. Taking the example of the reaction equation $CH_4 + 2H_2O$ reversible $CO_2 + 4H_2$, it is shown that the temperature is mainly responsible for the different isotope composition. (GE)

7318 CHRONOLOGY OF MARINE SEDIMENTS USING THE ^{10}Be METHOD: INTERCOMPARISON WITH OTHER METHODS. Amin, B. S. (Tata Inst. of Fundamental Research, Bombay); Lal, D.; Somayajulu, B. L. K. Geochim. Cosmochim. Acta; 39: No. 8, 1187-1192(Aug 1975).

The concentrations of the radionuclides, ^{10}Be, ^{230}Th, and ^{232}Th have been measured in four gravity cores from the Pacific and one piston core from the Indian Ocean. Three of the Pacific Ocean cores were studied for the presence of magnetic reversals. Accumulation rates based on the nuclear and magnetic methods fall in the range of 1 to 6 mm/10^3 yr and except in one case, are in fair agreement with each other. This result leads to the conclusion that the constants used in the ^{10}Be-dating equation are approximately correct (within ±30 per cent) and the usefulness of the cosmic ray produced nuclei ^{10}Be for dating Pliocene and recent sediments seems to be established, considering the underlying assumptions in the Be^{10}-dating method. (auth)

7319 $^{14}C/^{12}C$ RATIOS AS TRACERS OF URBAN POLLUTION. Baxter, M. S. (Univ. of Glasgow); Harkness, D. D. pp 135-141 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Since fossil carbon is ^{14}C-free environmental materials influenced by industrial activity have $^{14}C/^{12}C$ ratios which are measurably depressed below natural values. In this study $^{14}C/^{12}C$ ratios in samples from an industrial region are compared with those in relatively unpolluted materials. It is shown that artificial sedimentation rates in the coastal sewage dumping area off the West of Scotland are an order of magnitude higher than the natural rate for this region. The $^{14}C/^{12}C$ ratio in the normal industrial atmosphere shows that up to 20 percent of the total carbon dioxide content is derived from local combustion of fossil fuels. This may be compared with a circa 6 percent contribution on a worldwide basis. (auth)

7320 CARBON-14 AS AN INDICATOR OF CO_2 POLLUTION IN CITIES. Vogel, J. C.; Uhlitzsch, I. (National Physical Research Lab., Pretoria). pp 143-152 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The combustion of fossil fuels in cities, and especially in industrial areas, releases large quantities of carbon dioxide into the local atmosphere. This carbon dioxide does not contain carbon-14, with the result that the carbon-14 content of the atmospheric carbon dioxide is locally depleted. The degree of depletion provides a measure for the carbon dioxide pollution at the sampling site. Since growing plants represent a convenient average sample of the carbon dioxide in the air, the leaves of deciduous trees can be used for comparing the magnitude of local pollution in different localities during the summer growing period. A series of leaf samples collected in 1973 from Europe, North America and South Africa reveals the expected differences in the degree of pollution. Extreme instances occur in Scholven (Ruhrgebiet, Germany), where the average day-time carbon dioxide content during the summer months is found to be 8.7 percent above normal, and in Manhattan, New York City, where the corresponding figure is 6.4 percent. The technique can easily be extended to include the winter months by directly absorbing carbon dioxide in a hydroxide solution during different seasons. The proposed method is sensitive but much less time-consuming than the continuous measurement of the carbon dioxide concentration in the air. It thus lends itself to the monitoring of impact areas of pollution. (auth)

7321 CYCLING OF ORGANIC CARBON IN THE OCEAN: USE OF NATURALLY OCCURRING RADIOCARBON AS A LONG AND SHORT TERM TRACER. Williams, P. M.; Linick, T. W. (Univ. of California, San Diego, La Jolla). pp 153-167 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The natural radiocarbon activities of surface, bathypelagic and benthic marine organisms have been measured for samples collected from the north central, north eastern and central equatorial Pacific Ocean and from the Ross Sea in Antarctica. These measurements show that 1961-1962 bomb-carbon-14 has been incorporated into the bathypelagic specimens in varying amounts. Thus, pollutants introduced into surface waters of the oceans may be removed more or less rapidly from the euphotic zone into the deep water depending upon particular food chain mechanisms. These results are discussed in relation to the cycling of dissolved organic carbon, the flux of particulate organic carbon through the seawater column into the sediments, and to the oxidation rates of organic matter in the deep sea. (auth)

7322 USE OF ENVIRONMENTAL ISOTOPES TO INVESTIGATE THE INTERCONNECTIONS BETWEEN THE RENO RIVER AND GROUNDWATER (NORTHERN ITALY). Carlin, F. (CNEN, Rome); Magri, G.; Cervellati, A.; Gonfiantini, R. pp 179-194 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

This research is part of the investigations carried out to assess the environmental impact of the Brasimone site in the upper reaches of the Reno River, where a nuclear research plant is under construction. This plant might imply a risk of contamination of the Reno River water by radioactive wastes. Environmental isotope techniques were used to study the interconnections between the Reno River and groundwater and qualitatively to define the flow dynamics between the surface waters and groundwater in the area of Bologna. The Reno River flows across an aquifer consisting of an irregular succession of alluvial beds of sandy gravel, sands and clayey or sandy silts of varying thicknesses. At the two pumping stations of Borgo Panigale and Tiro a Segno, the tritium and ^{14}C contents of the groundwater regularly decrease with increasing distance from the Reno River. This indicates that there is a contribution of recent water recharged from the river, and that such a contribution decreases as the distance from the river increases. For equal distances, the river contribution is higher in Borgo Panigale than in Tiro a Segno. At the pumping stations of San Vitale di Reno, only recently put into operation and at a distance from the river greater than that of the other two stations, there is no indication of recharge of recent river water. Stable isotopes also show a slight variation with the distance from the river, in agreement with the fact that deep groundwater is a mixture of variable proportions of two components, one of them originating from the river. All these results were possible to achieve only by means of environmental isotope techniques. (auth)

7323 Ge(Li) SPECTROMETRIC MEASUREMENTS OF ISOTOPIC URANIUM RATIOS IN SOILS TREATED WITH APATITE-DERIVED FERTILIZERS. Lindeken, C. L.; Coles, D. G.; Meadows, J. W. (Univ. of California, Livermore). pp 255-265 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Soil samples collected in an agricultural region of the Sacramento-San Joaquin Delta in central California contained levels of uranium as high as 17 ppm. Isotopic uranium analysis, determined by mass spectrometry, showed $^{235}U/^{238}U$ ratios of 7.1×10^{-3}, typical of natural uranium. However, the ^{238}U content inferred from gamma counting of the ^{226}Ra daughters disclosed marked disequilibrium in the ^{238}U decay series. The elevated levels of uranium are attributed to its presence in ammonium phosphate fertilizer produced from apatite [$CaF_2Ca_3(PO_4)_2$]. The ^{238}U daughter disequilibrium is due to removal of ^{226}Ra by coprecipitation with $CaSO_4$ during conversion of the raw material to phosphoric acid with sulphuric acid.

A more direct method for ^{238}U measurement based on detection of the 63-keV transition gamma of ^{234}Th and using Ge(Li) gamma spectrometry is described. This method is independent of ^{226}Ra daughters and can detect ^{238}U down to about 0.1 mu g/g in soils. A comparison with ^{238}U measurements using mass spectrometry shows agreement within +- 10 percent. (auth)

7324 RADIOCARBON AGES OF GROUND WATER AS A BASIS FOR THE DETERMINATION OF SAFE LIMITS OF AQUIFER EXPLOITATION. Tamers, M. A. (Nova Univ., Fort Lauderdale, FL); Stipp, J. J.; Weiner, R. Environ. Res.; 9: No. 3, 250-264(Jun 1975).

Deep ground waters of the Biscayne aquifer of south Florida were studied with radiocarbon dating techniques. Dissolved carbonates served as the material for the age determinations. Limestone dilution corrections of the measured carbon-14 activities were made by comparison of the relative concentrations of bicarbonate and total carbonates. The deep well waters of the southern portion of the deposit have corrected radiocarbon contents indicating thermonuclear weapon testing contamination; they are, therefore, less than 20 years old. The ages of the ground waters generally increase in the northern direction. This is interpreted as due to the greater depth of the deposit of that region. A model is formulated for ground water movement in an unconfined producing hydrological unit and applied to the radiocarbon results of the most intensively exploited zone of the Biscayne aquifer. It is shown that the water which is extracted by the municipal wells in this area is limited to the bottom third of the deposit. The avoidance of pollution from the surrounding septic tanks in the shallower depths of the area is explained in this way. The model leads to an objective estimation of the safe limit for the ground water extraction rate in the zone. By application of radiocarbon dating, it is possible to obtain useful information without disturbing the water supply. (auth)

7325 Ar ISOTOPES AND EARTH–ATMOSPHERE EVOLUTION MODELS. Ozima, M. (Tokyo Univ.). Geochim. Cosmochim. Acta; 39: No. 8, 1127-1134(Aug 1975).

Earth-atmosphere evolution models are mathematically simulated and the resulting present isotopic ratio ($^{40}Ar/^{36}Ar$) in the mantle is given for each. Differential outgassing experiments on several recent submarine glasses were made to estimate an isotopic ratio ($^{40}Ar/^{36}Ar$) in the present mantle. Estimations of ($^{40}Ar/^{36}Ar$) in the mantle by various methods are also critically reviewed. From the experimental results and these considerations a minimum value of 2000 for ($^{40}Ar/^{36}Ar$) ratio in the present mantle is inferred. By assuming that $(^{40}Ar/^{36}Ar)_M$ is larger than 2000 and that the potassium content in the present mantle is larger than 50 ppm, one can limit considerably a choice among various Earth-atmosphere evolution models, i.e. (1) a continuous degassing process cannot explain rare gas evolution in the atmosphere, (2) early sudden degassing is more likely and (3) such sudden degassing must have occurred earlier than 4.35 b.y. (auth)

7326 INVESTIGATION OF SOIL-SOLUTION SYSTEMS ON THE CAPTURE OF RADIOIODINE IN RELATION TO pH. Benes, J. (Lab. of Radiological Dosimetry, Prague). Collect. Czech. Chem. Commun.; 40: No. 70, 2012-2019(Jul 1975).

The paper describes pH changes of solutions brought into contact with soils and the effect of pH on the capture of microconcentrations of iodide in solution (followed with the aid of ^{131}I) by soils. Except for strongly acid media the sorption of iodide was inversely proportional to pH of the solution. Factors affecting the sorption, viz. time of the soil-solution contact, concentration of an indifferent electrolyte and the pre-conditioning of the soil, have also been studied. The reduced sorption of iodide from strongly acid solutions is explained and possible mechanisms of the processes are discussed. (auth)

7327 LEAD ISOTOPIC SYSTEMATICS AND AGES OF ARCHAEAN ACID INTRUSIVES IN THE KALGOORLIE-NORSEMAN AREA, WESTERN AUSTRALIA. Oversby, V. M. (Australian National Univ., Canberra). Geochim. Cosmochim. Acta; 39: No. 8, 1107-1125(Aug 1975).

Lead-lead mineral isochrons consisting of K-feldspar + plagioclase + total rock have been determined for eight intrusive bodies in the Kalgoorlie-Norseman area of Western Australia. The ages found range from 2630 to 2760 m.y. Variation of initial lead isotopic composition within plutons has been identified in two cases. For the remaining plutons, whole rock lead-lead isochrons give the same age as the mineral isochrons. Attempts to determine uranium-lead ages reveal large-scale loss of uranium from surface rocks in recent times. The initial lead isotopic composition of the intrusions, as estimated from age corrected K-feldspar data, shows that the source regions for the plutonic magmas must have experienced multistage histories prior to magma generation. The time integrated μ value for the source region in all cases exceeds the mean μ value for the Earth. Multistage model calculations show that continental type rocks must have been present in the Norseman area as early as 3300 m.y. ago. Original formation of continental crust near Kalgoorlie either occurred much later than at Norseman, or consisted of more basic rock types. (auth)

7328 MEASUREMENT OF THE ALLUVIAL DEPOSIT TRANSPORT BY MEANS OF RADIOACTIVE TRACERS. Erdelyaky, Z. (Technical Univ. of Budapest). Oesterr. Wasserwirtsch.; 26: No. 3/4, 89-92(1974). (In German).

The propagation of alluvial deposit of different particle sizes in the Danube River was studied by radioactive tracers. Four different radioactive isotopes with characteristic gamma-components and intensities (Zn-65, Zr-95, Hf-181 and Sb-124) were embedded in pebbles of different sizes and sealed by araldit resin. The pebbles were laid in the river and their propagation was followed up by systematic scanning of the riverbed by means of scintillation detectors. The pebbles were found to be carried away by the water stream in a narrow strip of 2.5 m in width, maintained even after a path of 1,600-2,000 m at a flow rate of 0.75 m/sec measured near the riverbed, a 3 mm-particle had a velocity of 0.21 m/sec. (auth)

7329 POSSIBILITIES OF WATER DATING BY MEANS OF INERT GAS ISOTOPES. Oeschger, H.; Gugelmann, A. (Bern Univ.). Oesterr. Wasserwirtsch.; 26: No. 3/4, 54-56(Apr 1974). (In German)

Possibilities of water dating in hydrology, oceanology, and glaciology by means of inert gas isotopes, and actual dating performed by this method are described. The inert gas isotopes suitable for dating water of different ages are 37Ar, 39Ar, 81Kr, and 85Kr with the respective half-life periods of 35 days, 269 yrs, 210,000 yrs, and 10.6 yrs. For water dating, the water sample is first heated to 85 to 100 C under atmospheric pressure for the separation of the gases. Krypton and argon are then separated from oxygen and nitrogen by oxidation of the latter over hot copper followed by fractionated distillation. Argon and krypton are then separated from each other by a chromatographic method. The radioactivity is measured by means of proportional counter. Water dating by means of such inert gas isotopes is suitable for the determination of the age and age distribution of water, of the motion and turbulence of water masses in oceans, and of the age of different layers of glaciers. (auth)

7330 EXPERIENCES WITH THE ^{14}C AND TRITIUM METHODS IN APPLIED HYDROGEOLOGY. Geyh, M. A. Oesterr. Wasserwirtsch.; 26: No. 3/4, 49-54(Apr 1974). (In German)

Experiences gained during the last five years with the application of the 14C and tritium tracing methods in applied hydrogeology are presented. The tracer methods proved useful, especially in the study of underground waters in confined aquifers in loose rocks. These methods were used primarily for the determination of the flow velocity and direction, for the localization of water capture areas and preferred flowpaths, as well as for the exploration of hydraulic communications among different groundwater systems. In the case of unconfined aquifers in loose rocks, tracing methods supply qualitative information on the hydrodynamic conditions. Reliable, quantitative interpretation of the results is possible. The interpretation of tracing data in solid rocks is problematic and even impossible if large storage spaces are present in the source and capture area. (auth)

7331 EFFECTIVE DISINFECTION OF SEWAGE WATER BY GAMMA RADIATION. Murphy, K. J. (McMaster Univ., Hamilton, Ont.). Ind. Miljoe; 5: No. 8, 5-9(Nov 1974). (In Norwegian)

The effectiveness of chlorination of sewage water has been questioned in recent years. A content of ammonium and/or amino compounds can lead to the formation of stable chloramines which are toxic. The production of chlorine is also energy intensive. A pilot plant for gamma irradiation of sewage water has been installed and operated at the Skyway sewage treatment plant at Burlington, Ontario, Canada, utilizing a 39,900 Ci Co-60 source in a 200 l reactor, having a capacity of 10 to 115 m^3/day. Tests have been carried out with doses between 1×10^4 and 1.5×10^5 Rad which show an inverse logarithmic relationship between the dose and the probability of survival of microbes. The percentage mortality of several bacteria with full chlorine treatment, gamma doses of 5×10^4 and 10^5 Rad, and combined treatment have been compared. Chlorine treatment gives a mortality of 12 to 17% while gamma irradiation gives 46 to 97% and 84 to 99% respectively and combined treatment 97 to 99.9% and 98 to 99.9% respectively. The gamma treatment was not found to lead to chemical changes in the water, which had no toxic effect on goldfish, whereas the goldfish died rapidly in chlorinated water. The cost of Co-60 sources should be stable, while other costs rise, which should make their use economically viable. (NO)

7332 COMPARISON OF FISSION-TRACK, K–Ar, AND Rb–Sr RADIOMETRIC AGE DETERMINATIONS FROM SOME GRANITE PLUTONS IN MAINE. Naeser, C. W.; Brookins, D. G. Res. U.S. Geol. Surv.; 3: No. 2, 229-231(1975).

Fission-track ages have been determined on eight apatite and four sphene concentrates separated from plutonic rocks in Maine. K–Ar and Rb–Sr ages for some of these rocks were previously published. In northeastern Maine the whole-rock Rb–Sr, biotite K–Ar, and apatite fission-track ages are concordant at 400 to 420 million years, whereas in south-central Maine the apatite fission-track age is 150 m.y. and the biotite K–Ar age is about 250 m.y. At intermediate positions along the traverse the whole-rock Rb–Sr, biotite K–Ar, and sphene fission-track ages agree fairly well in the range 390 to 325 m.y., but the apatite fission-track ages are all about 100 m.y. younger. This pattern is consistent with the hypothesis of burial metamorphism and uplift as proposed in 1970 by Zartman, Hurley, Krueger, and Giletti to explain the abundance of Permian K–Ar ages in central New England. (auth)

7333 NEW TRITIUM DATA ON MOVEMENT OF GROUNDWATER IN WESTERN FRESNO COUNTY, CALIFORNIA. Poland, J. F. (U. S. Geological Survey, Sacramento, CA). Water Resour. Res.; 11: No. 5, 716-724(Oct 1975).

Well waters along two traverse lines were sampled in 1963 and tested for tritium concentration. Haskell et al. [1966] estimated from the apparent thermonuclear tritium concentrations that groundwater had moved westward in the lower water-bearing zone at a maximum velocity of 14–16.5 mi (23-27 km) in 9 yr. The maximum velocities and permeabilities estimated from the 1963 sampling were about an order of magnitude greater than the velocities and permeabilities suggested by prior hydrologic and geologic evidence. Consequently, in 1966-1970 the U. S. Geological Survey sampled and tested the tritium concentrations of well waters along the same two traverses but also extended the sampling eastward. On the basis of these analyses it is concluded that (1) thermonuclear tritium had not invaded the lower zone by 1970 within the extent of the 1963 sampling and (2) although the maximum westward movement of groundwater in the lower zone from 1955 to 1970 is indeterminate, it has been less than 4 mi (6.5 km) from the recharge area in 15 yr. (auth)

Site Surveys

Refer also to abstract 7907.

7334 (COO-2307-9) BIOLOGICAL/ENVIRONMENTAL RELATIONSHIPS IN DESERT ECOSYSTEMS OF THE NEVADA TEST SITE. Progress Report, February 1, 1975–January 31, 1976. Beatley, J. C. (Cincinnati Univ., Ohio (USA). Dept. of Biological Sciences). 1975. Contract E(11-1)-2307. 4p. Dep. NTIS $4.50.

Progress is reported on the compilation of a list of vascular flora of the Nevada Test Site during 1975. No technical data are included. (CH)

7335 (PRNC-188) CABLO MALA PASCUA ENVIRONMENTAL STUDIES. Wood, E. D.; Youngbluth, M. J.; Yoshioka, P.; Canoy, M. J. (Puerto Rico Nuclear Center, Mayaguez). 15 Jun 1975. 93p. Dep. NTIS $6.00.

Results are reported from a survey of the Cabo Mala Pascua area of Puerto Rico to determine the practicability of locating a power generating plant at the site. The geological features of the site are described and data are presented on the tides and currents; seasonal variations in water temperature, density, and salinity; the variety and biomass of zooplankton, benthic invertebrates, and fishes in the coastal waters; and plant associations of the coastal area. (CH)

7336 (TID-26912) GEOLOGY, PHYSICAL PROPERTIES, AND SURFACE EFFECTS AT DISCUS THROWER SITE, YUCCA FLAT, NEVADA TEST SITE. Carr, W. J.; Miller, C. H.; Dodge, H. W. Jr. (Alliance for Engineering in Medicine and Biology, Chevy Chase, Md. (USA)). 1975. Contract AT(29-2)-474. 135p. Dep. NTIS $7.00.

Geologic studies in connection with Project Discus Thrower have furnished detailed stratigraphic and structural information about northwestern Yucca Flat, Nevada Test Site. The Paleozoic rocks consist of a lower carbonate sequence, argillite of the Eleana Formation, and an upper carbonate sequence. The distribution of these rocks suggests that both top and bottom of the Eleana are structural contacts, probably thrusts or reverse faults. The overlying tuff includes several units recognized in the subsurface, such as the Fraction Tuff and tuff of Redrock Valley. Other units recognized include bedded tuff associated with the Grouse Canyon Member of Belted Range Tuff, and the Rainier Mesa and Ammonia Tanks Members of the Timber Mountain Tuff. The Timber Mountain and Grouse Canyon are extensively altered to montmorillonite (a swelling clay), possibly as a result of ponding of alkaline water. The overlying alluvium locally contains at the base a clayey, tuffaceous sandstone. (auth)

7337 (USGS-474-207) GEOLOGY OF THE U12n.07 UG-3 DRILL HOLE, AREA 12, NEVADA TEST SITE. Terry, S. S.; Cunningham, M. J. (Geological Survey, Denver, Colo. (USA)). Nov 1975. 88p. Dep. NTIS $6.00.

The U12n.07 UG-3 horizontal drill hole, located near the eastern edge of the center of Rainier Mesa, Nevada Test Site, was drilled to a total depth of 809 m (2,653 ft). This hole was drilled to further evaluate the tunnel-level stratigraphy and structure southwest of the U12n tunnel complex. The drill hole is collared in the middle of Tertiary tunnel bed 3A and penetrates upsection through tunnel beds 3 and 4 and terminates in subunit 4K, all of Tertiary age. Stratigraphy, structure, engineering geology, and physical properties and their relation to tunnel engineering are discussed. (auth)

7338 (USGS-474-213) GEOLOGY OF THE UE12t No. 3 VERTICAL DRILL HOLE, AREA 12, NEVADA TEST SITE. Terry, S. S. (Geological Survey, Denver, Colo. (USA)). Nov 1975. 43p. Dep. NTIS $4.00.

The UE12t No. 3 vertical drill hole, located near the north end of Rainier Mesa, was drilled to a total depth of 663 m (2,176 ft). The UE12t No. 3 vertical hole was drilled to further evaluate the subsurface stratigraphy northwest of the t-tunnel complex area in preparation for mining of the U12t.03 (Husky Pup) drift. The drill hole is collared in the Rainier Mesa Member of the Timber Mountain Tuff and penetrates down the stratigraphic section through the Paintbrush Tuff, the welded Grouse Canyon Member of the Belted Range Tuff, tunnel beds 5-3, the Tub Spring Member of the Belted Range Tuff, tunnel bed 2, Crater Flat Tuff, tunnel bed 1, Redrock Valley Tuff, and bottoms in older Tertiary tuffaceous and Paleozoic quartzite rubble having a partially argillized, tuffaceous, soillike matrix. The tuff of Dead Horse Flat and the bedded and ash-flow tuffs of Area 20 were not differentiated in the logging of this drill hole. Stratigraphy, structure, engineering geology, and physical properties and their relation to tunneling are discussed. (auth)

Thermal Effluents

Refer also to abstract 7346.

7339 (ATDL-75/17, pp 15-54) METEOROLOGICAL EFFECTS OF THE COOLING TOWERS AT THE OAK RIDGE GASEOUS DIFFUSION PLANT. II. Predictions of Fog Occurrence and Drift Deposition. Hanna, S. R. Sep 1975.

In 1974 annual report. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.).

The frequency of occurrence of fogs and the rate of deposition of chromate due to emissions from the cooling towers at the Oak Ridge Gaseous Diffusion Plant are calculated. Observations of drift deposition agree fairly well with calculated values. A detailed summary of significant findings is given. (auth)

7340 (ATDL-75/17, pp 55-70) METEOROLOGICAL EFFECTS OF THE MECHANICAL-DRAFT COOLING TOWERS OF THE OAK RIDGE GASEOUS DIFFUSION PLANT. Hanna, S. R. Sep 1975.

In 1974 annual report. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.).

The mechanical-draft cooling towers at the Oak Ridge Gaseous Diffusion Plant dissipate about 2000 MW of heat. Downwash occurs about 40 percent of the time, when wind speeds exceed about 3 m/sec. An elevated cloud forms about 10 percent of the time. The length of the visible plume, which is typically 100 or 200 m, is satisfactorily modeled if it is assumed that the plumes from all the cells in a cooling-tower bank combine. The calculation of fog concentration is complicated by the fact that the moisture is not inert but is taking part in the energy exchanges of a thermodynamic system. Calculations of drift deposition agree fairly well with observations. (auth)

7341 (ATDL-75/17, pp 91-109) PLUME RISE FROM MULTIPLE SOURCES. Briggs, G. A. Sep 1975.

In 1974 annual report. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.).

A simple enhancement factor for plume rise from multiple sources is proposed and tested against plume-rise observations. For bent-over buoyant plumes, this results in the recommendation that multiple-source rise be calculated as $[(N+S)/(1+S)]/\sup 1/3/$ times the single-source rise, DELTA h_1, where N is the number of sources and S equals 6 (total width of source configura-

tion/N/sup 1/3/ DELTA h_1)/sup 3/2/. For calm conditions a crude but simple method is suggested for predicting the height of plume merger and subsequent behavior which is based on the geometry and velocity variations of a single buoyant plume. Finally, it is suggested that large clusters of buoyant sources might occasionally give rise to concentrated vortices either within the source configuration or just downwind of it. (auth)

7342 (ATDL-75/17, pp 127-133) FOG AND DRIFT DEPOSITION FROM EVAPORATIVE COOLING TOWERS. Hanna, S. R. Sep 1975.

In 1974 annual report. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.).

Methods of determining fog and drift deposition due to emissions from evaporative cooling towers are reviewed and formulas suggested that can be used as a basis for calculations. The Gaussian plume formula is recommended for calculating fog concentrations from which visibility can be estimated. For drift droplets with diameters greater than 200 mu m, deposition is calculated by ballistics methods, knowing the environmental wind speed and relative humidity and the vertical velocity of the plume and the droplet. Evaporation of the droplets is accounted for. Drift droplets with diameters less than 200 mu m are assumed to be dispersed according to the Gaussian plume formula, with the plume tilted downward to account for the settling speed of the droplet. (auth)

7343 (ATDL-75/17, pp 169-179) RESEARCH NEEDS RELATED TO HYDROMETEOROLOGIC ASPECTS OF FUTURE ENERGY PRODUCTION. Hanna, S. R. Sep 1975.

In 1974 annual report. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.).

Plans are being made to develop large power parks and energy centers which will dissipate several thousand megawatts of waste heat to the atmosphere. Characteristics of these energy centers are discussed and estimates of environmental impact are made. Research needs are outlined. (auth)

7344 ENVIRONMENTAL AND INTRINSIC CONTROL OF FILTERING AND FEEDING RATES IN ARCTIC DAPHNIA. Chisholm, S. W. (State Univ. of New York, Albany); Stross, R. G.; Nobbs, P. A. J. Fish. Res. Board Can.; 32: No. 2, 219-226(Feb 1975).

Filtering and feeding rates of Daphnia middendorffiana at Point Barrow, Alaska were measured as a function of temperature, food density, animal length, and time of day. The functional relationship between feeding rate and food density followed the hyperbolic pattern typical for filter feeders. Daphnia middendorffiana was found to have comparatively high filtering capabilities at its temperature optimum (around 11 C), with filtering rate increasing with length according to the equation $F = .458L^{3.17}$. The exponent of this equation was found to be a function of temperature, and the coefficient a function of food density. A bimodal diel rhythm in feeding rate was found in this species in experiments where the animals were held under constant conditions. Feeding rates were maximum at 1400 and 2400, the time of day when the temperature cycle in the ponds passes through the mean daily temperature, which is optimum for feeding in D. middendorffiana. Thus the timing of the rhythm may serve to maximize the daily food gathering ability of this species. (auth)

7345 METHOD AND MEANS FOR HEATING BUILDINGS IN A DISTRICT HEATING SYSTEM WITH WASTE HEAT FROM A THERMAL POWER PLANT. Margen, P.H.E. (to Aktiebolaget Atomenergi). US Patent 3,890,787. 24 Jun 1975. Priority Date 17 Mar 1972, Sweden. 8p.

The waste heat from a thermal power plant is transported through a municipal heating network to a plurality of buildings to be heated. The quantity of heat thus supplied to the buildings is higher than that required for the heating of the buildings. The excess heat is released from the buildings to the atmosphere in the form of hot air. (auth)

Chemical Effluents

Refer also to abstracts 7279 and 7339.

7346 (ATDL-75/17, pp 153-161) COMPARISON OF ESTIMATION PROCEDURES FOR OVER-WATER PLUME DISPERSION, SEPTEMBER 1974. Hosker, R. P. Jr. Sep 1975.

In 1974 annual report. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.).

Effluent transport and diffusion over water is receiving increased study, largely because of the current interest in off-shore nuclear power plants. Dispersion estimations identical to those used over land are open to question because, for given weather conditions (e.g., clear skies, moderate wind), the over-water turbulence will differ greatly from that over land. This paper attempts to assess the predictive capability of techniques similar to those in general use, but which utilize descriptions of turbulence perhaps more appropriate to over-water flows. (auth)

7347 (INIS-mf-1411) ENVIRONMENTAL SURVEILLANCE AT NUCLEAR FUEL COMPLEX, HYDERABAD. Khan, A. A.; Viswanathan, S.; Lakshmanan, A. R. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 11p. (CONF-730495-1). INIS.

From 1st annual conference of Indian Association for radiation protection; Bombay, India (12 Apr 1973).

The Nuclear Fuel Complex at Hyderabad is organized to meet the requirements of the country's nuclear fuel production program. The complex comprises various production units for zirconium oxide and sponge, uranium oxide, special materials and finished fuel fabrication plant. The chemical liquid waste is of the order of 100 cubic meters per day and toxic gases like CO, NO, NO_2, SO_2, etc. are discharged to the atmosphere in significant amounts. The aquatic effluents from the plants were mostly released in evaporation ponds, and some of them have found way to storm drains. The chemical pollutants have been identified in environmental samples from paddy fields and well waters. Results of evaporation rate studies and environmental investigations at length are reported. (INIS)

7348 (STI/PUB-382) ISOTOPE RATIOS AS POLLUTANT SOURCE AND BEHAVIOUR INDICATORS. Proceedings of a Symposium Held in Vienna, 18-22 November 1974. Proceedings Series. (International Atomic Energy Agency, Vienna (Austria)). 1975. 497p. (In several languages). (CONF-741120-). IAEA $31.00.

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974).

Separate abstracts were prepared for the 34 papers presented at the conference. A final summary and author index are included. (HLW)

For abstracts of individual papers see: 6969, 6970, 7273, 7274, 7286, 7287, 7295–7297, 7299, 7302, 7319–7323, 7340, 7350–7356, 7596, 7617, 7618, 7632, and 7650–7655.

7349 APPLICATION OF STABLE CARBON ISOTOPE RATIOS AS WATER QUALITY INDICATORS IN COASTAL AREAS OF CANADA. Tan, F. C.; Walton, A. (Bedford Inst. of Oceanography, Darmouth, Novia Scotia). pp 35-47 of Isotope Ratios as Pollutant Source and Behavior Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The principles, applicability and limitations of the $^{13}C/^{12}C$ technique in water quality studies are discussed and critically evaluated. Preliminary results from Bedford Basin, an area which receives considerable domestic sewage effluent, and St. Margaret's Bay, Nova Scotia, Canada, a relatively pollution-free marginal bay, are presented and discussed. (auth)

7350 DETERMINING THE EXTENT OF OXIDATION OF SULFUR DIOXIDE IN POWER PLANT PLUMES FROM ISOTOPIC RATIO MEASUREMENTS. Newman, L.; Forrest, J.; Manowitz, B. (Brookhaven National Lab., Upton, NY). pp 63-76 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The extent of oxidation of sulphur dioxide to sulphate in the plumes of oil and coal fired power plants have been studied by sampling with a single engine aircraft. A new technique employing isotopic ratio measurements was employed in conjunction with simultaneous concentration measurements of sulphur dioxide and sulphate. The method is based on measuring the isotopic ratio of the $^{32}S/^{34}S$ naturally occurring in the fuel sulphur. Changes were experienced in these ratios due to chemical reactions in the atmosphere. These changes were measured and interpreted as to an implied reaction. A mechanism is postulated whereby the sulphur dioxide is in equilibrium with water on particulates originating from the fuel. The sulphur dioxide is immediately catalytically oxidized by constituents of the particulates. In the oil fired instance a pseudo second order mechanism depending on sulphur dioxide and particulate concentrations is indicated and no dependency on relative humidity observed. The rate of reaction is 1 $ppm^{-1} \cdot h^{-1}$. In the coal fired instance the particulate level is a factor of 3 less than in the oil fired plume and the extent of reaction is reduced by about that amount. (auth)

7351 SULFUR ISOTOPIC VARIATIONS IN RELATION TO SULFUR POLLUTION OF LAKE ERIE. Nriagu, J. O. (Canada Centre for Inland Waters, Burlington, Ont.). pp 77-93 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The background sulphate concentration has been estimated to be 6.4 mg . l^{-1}, implying that the anthropogenous sources account for 60 to 70 percent of sulphate concentration in Lake Erie water. From 1850 AD, the sulphate contribution due to pollution increased at the rate of 2 mg . l^{-1} per decade, but has levelled off (at 16 mg . l^{-1}) during the last decade. An annual sulphur budget for the lake is presented and the storage time for sulphate (2.3 a) shown to be effectively the same as the water flushing time of 2.6 a. The data presented show that the sulphur inputs from the various sources may be identified on the basis of their delta^{34}S values; the use of sulphur isotopic variations to trace the movement (and mixing patterns) of the different water masses requires a further study. Only a small fraction (less than 2 percent) of the annual sulphur inputs into the lake is retained in the sediments. Dissolved sulphate in the interstitial waters (in contact with the sediments) generally disappears below 5 cm from the mud-water interface; the presence of large populations of viable sulphur cycle bacteria therefore indicates extensive microbial recycling of sulphur at the lower depths. The sediment samples analyzed show that elemental-S, organic-S and iron sulphides (hydrotroilite-mackinawite-greigite and framboidal pyrite) are present in proportions that vary with the geographic location and age of the sediments. Isotopic exchange across the mud-water interface occurs with a net loss of either ^{34}S (anaerobic Central Basin sediments) or ^{32}S (aerobic Eastern Basin sediments). The distribution and isotopic composition of sulphur in the sediments of the Western Basin would suggest that the hypolimnion of the basin had been anaerobic some time in the past. (auth)

7352 ISOTOPE RATIOS OF LEAD AS POLLUTANT SOURCE INDICATORS. Chow, T. J.; Snyder, C. B.; Earl, J. L. (Univ. of California, San Diego, La Jolla). pp 95-108 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Each lead ore deposit has its characteristic isotope ratios which are fixed during mineral ore genesis, and this unique property can be used to indicate the source of lead pollutants in the environment. The world production of primary lead is tabulated, and the geochemical significances of lead isotope ratios are discussed. The manufacture of lead alkyl additives for gasoline, which is the major source of lead pollutants, utilizes about 10 percent of the world annual consumption of lead. The isotope ratios of lead in gasoline, aerosols, soils and plants are correlated. Lead additives in various brands of gasoline sold in one region do not have the same isotope ratios. Regional variations in isotope ratios of lead additives were observed. This reflects the fact that petroleum refineries obtained the additives from various lead alkyl manufacturers which utilized lead from different mining districts. A definite changing trend of isotope ratios of lead pollutants in the San Diego, California (USA), area was detected. The lead shows a gradual increase in its radiogenic components during the past decade. This trend can be explained by the change of lead sources used by the additive manufacturers: Lead isotope ratios of the mid-1960's gasoline additives in the United States of America reflected those of less radiogenic leads imported from Canada, Australia, Peru and Mexico. Since then, the U. S. lead production has doubled--mainly from the Missouri district of highly radiogenic lead. Meanwhile, there has been a decrease in total lead imports. These combined effects result in changes in isotope ratios, from the less to more radiogenic, of the pooled lead. (auth)

7353 PETROL WITH ISOTOPICALLY DIFFERENTIATED LEAD ADDED. Magi, F. (Ente Nazionale Idrocarburi, Rome); Facchetti, S.; Garibaldi, P. pp 109-119 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975). (In Italian).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

An experiment is proposed aimed at determining the role of motor traffic in the pollution of the environment by lead, in particular of air, soil, vegetation, food and the human body. The technique of determining the isotopic composition of lead, used in the right way, should enable the whole problem to be solved. It is intended to add lead with a constant isotopic composition different from that of normally occurring lead, whether natural in origin or otherwise, to petrol in at least two regions of Italy. Analyses of lead samples taken from the principal mines have shown that Australian lead (Broken Hill Mine) has quite a different isotopic composition. This lead will therefore be used to prepare the anti-knock additives for petrol sold in the regions in question. Adequate sampling should make it possible to determine the contribution to pollution of lead from motor vehicle exhausts. The regions chosen for the experiment are Piedmont (city and province of Cagliari)--the first because of its high traffic density and level of industrialization, the second because of its remoteness and the lead content of the soil, which may affect food. Both regions present favourable conditions for supplying petrol of the intended type. The experiment is intended to last three years; the petrol with Australian lead will be marketed for a period of 18 months. The first results of analyses of the isotopic composition of lead contained in atmospheric dust in the city of Turin and of lead from a number of blood samples are reported in the paper. (auth)

7354 PROBLEMS AND POTENTIALITIES OF STABLE ISOTOPES AS TRACERS FOR STUDYING POLLUTANT BEHAVIOUR UNDER FIELD CONDITIONS. Matwiyoff, N. A.; Cowan, G. A.; Ott, D. G.; McInteer, B. B. (Los Alamos Scientific Lab., NM). pp 305-325 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The separated stable isotopes of carbon (^{12}C, ^{13}C), oxygen (^{16}O, ^{17}O, ^{18}O), and nitrogen (^{14}N, ^{15}N) (the ICONs) have been available in limited quantities for many years. These non-radioactive, naturally occurring forms of the elements are the basic building blocks of natural compounds and of pollutants, and their great potential utility for tracer studies has long been recognized. However, in practice, the use of these isotopes has been limited primarily for two reasons. First, the separated isotopes in the required chemical forms have been relatively expensive. Second, the analytical instrumentation necessary for their detection and assay has been expensive to acquire and difficult to maintain. Recently this situation has begun to change rapidly and, in this paper, we review the problems and potentialities of stable isotopes as tracers for studying pollutant behaviour under field conditions. In this review, the radically changed situation with respect to increased supplies of the ICONs at low cost will be discussed against the backdrop of the continued high cost of certain isotopically labelled compounds and of analyses. Prospects for improvements in the latter areas will be explored in the context of the experience accumulated at the Los Alamos Scientific Laboratory in ICONs research and development activities directed toward ICONs production, synthesis of labelled compounds, and analytical techniques for ICONs. The potential and actual applications of ICONs for studying pollutant behaviour under field conditions will be surveyed with emphasis on: the use of ^{15}N and ^{14}N (depleted in ^{15}N) for tracing N tagged fertilizer; the use of mass spectrometry and nuclear magnetic resonance spectroscopy for studying the distribution and fate of ^{13}C and ^{15}N tagged pesticides in the biosphere; and the use of tagged methane as a tracer for transport and dispersion studies in the atmosphere. (auth)

7355 NEW METHOD OF DETERMINING VERY SLIGHT TRACES OF NITROGEN PEROXIDE (NO_2) IN POLLUTED ATMOSPHERES, BY ISOTOPE DILUTION AND MASS SPECTROMETRY. Stevens, C. M.; Barat, F.; Nguyen-Nghi, H. (CEN, Saclay, France). pp 389-402 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975). (In French)

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The authors propose a new method of determining nitrogen peroxide (NO_2) in the atmosphere or the stratosphere at very low concentrations, of the order of pp10^9 by volume or even less. This method employs isotopic dilution with $^{15}NO_2$ followed by conversion into N_2 and isotopic analysis by mass spectrometry. It consists of mixing homogeneously a known quantity of $^{15}NO_2$ with the sample of air. After separation of H_2O, HNO_3, CO_2, and N_2O, the nitrogen peroxide is transferred to a silica reactor by trapping at -196^{0}C. This reactor contains electrolytic copper which, when heated to 580^{0}C for 1½ h, reacts with NO_2 to give N_2. The ratio of masses 29 and 30, corresponding to $^{15}N^{14}N$ and $^{15}N^{15}N$, is then determined by mass spectrometry. The sensitivity of the method is limited by the contamination that occurs while processing the sample under analysis (by reagents or by the separation and the measurement equipment). If the experiment is well programmed, this contamination is reproducible and can at present be given as (4.5 +- 0.5) x 10^{-2} mm^3 (NTP) of N_2. This very sensitive method of determination was developed for the investigation of possible pollution of the stratosphere by super-

sonic aircraft. The authors have used it to measure the NO_2 content of the air at ground level at the Saclay Nuclear Research Centre (air sample taken in two minutes; content found: 56 and 74 $pp10^9$ by volume). Thanks to its sensitivity it could be used without major difficulties to determine the quantity of nitrates in food, soil and water, $^{15}NO_3^-$ being used as a tracer instead of $^{15}NO_3$. (auth)

7356 USE OF SULFUR-34 TO MEASURE THE ABSORPTION RATE OF SULFUR DIOXIDE ON THE LEAVES OF PLANTS. Belot, Y. (CEN, Fontenay-aux-Roses, France); Bourreau, J. C.; Dubois, M.; Pauly, C. pp 403-416 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975). (In French)

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

A new method has been developed for measuring the rate of sulphur dioxide absorption by plants. This rate is deduced from the isotopic composition of the sulphur contained in plants before and after fumigation with ^{34}S-enriched sulphur dioxide, the production of which is also described. The fumigation, which is carried out in the field with a special device, is limited to a period of the order of tens of minutes so as not to alter the physiological state of the plant. In the next stage, the plant sulphur is transformed, by calcination under oxygen, into a soluble sulphate and then precipitated as barium sulphate, which is finally decomposed into pure sulphur dioxide at 1500^0C, with no isotopic effects. Variations in the isotopic composition of the sulphur dioxide collected in this manner are determined very accurately with a double-focusing mass spectrometer. The experimental results indicate that one can measure a sulphur deposit of several micrograms per gram of plant with quite acceptable accuracy. (auth)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstracts 7502, 7504, 7505, and 8599.

7357 USE OF ^{137}Cs IN TELERADIOTHERAPY. Bibergal, A. V.; Vainberg, M. Sh.; Zhukovskii, E. A.; Rimman, A. F.; Ruderman, A. I.; Sul'kin, A. G. pp 399-403 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The development of teleradiotherapeutic devices with ^{137}Cs in the USSR is reviewed. Its advantages with respect to cost, simplicity of operation, maintenance, and safety are summarized. (JSR)

General Detectors and Monitors

Refer also to abstracts 7683 and 7696.

7358 (AED-CONF-75-141-009) WHOLE-BODY COUNTER FOR CLINICAL PRACTICE AND RADIATION PROTECTION. Werner, E.; Morsy, S. M. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Frankfurt am Main (F. R. Germany). Abt. fuer Biophysikalische Strahlenforschung). 1975. 7p. (In German). INIS.

From 6th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik e.V.; Berlin, F. R. Germany (28 Apr 1975).

1 fig.; 5 refs.

It is important to measure the total activity most accurately when using a whole-body counter. In the whole-body counters described so far with detector arrangement of NaI(Tl) crystals, deviations of at least a factor of two occur for point sources of the same activity in the center of the body or on the surface. To reduce these differences in susceptibility, a measuring device with 4 detectors was designed in which outer body sections are partially shielded as opposed to the body center point. The shielding is achieved by a collimator system with rectangular opening and by a particular arrangement of the crystals in the collimators. A uniform susceptibility in a longitudinal direction can be achieved by moving the patient's bed through the detector arrangement. The system has a simple construction and guarantees a homogeneous susceptibility over the total body cross-section with deviations of less than 20% of the value at the center of the body. (GE)

7359 (AED-CONF-75-141-010) IMAGE PROCESSING IN SCINTIGRAMS BY FACTOR ANALYSIS. Schmidlin, P.; Roesel, F.; Schlegel, W. (Deutsches Krebsforschungszentrum, Heidelberg (F. R. Germany). Inst. fuer Nuklearmedizin). 1975. 9p. (In German). INIS.

From 6th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik; Berlin, F. R. Germany (28 Apr 1975).

The method of factor analysis was applied to image processing in static scintigraphy, where it proved to be superior to other filter methods in various respects. Prominent features of image processing by factor analysis are its non-parametric character and its truth to shape. Special features and possibilities of this method are discussed by examples. (GE)

7360 (BNWL-CC-1834) BURST REACTOR TESTS OF A NEUTRON SENSITIVE CRITICALITY DETECTOR. Friend, P. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 30 Sep 1968. 8p. Dep. NTIS $4.50.

The Pacific Northwest Laboratory in Richland, Washington, operated by Battelle Memorial Institute for the Atomic Energy Commission has a new alarm system to detect and warn of uncontrolled nuclear criticality accidents. The basic elements of the system, neutron sensitive criticality detectors were tested at pulsed reactor sites. Results are presented. (WHK)

7361 (CONF-751116-6) REJECTION OF RADIO-FREQUENCY NOISE WITH A WIDE-BAND DIFFERENTIAL PREAMPLIFIER AND SOLID-SHIELDED COAXIAL INPUT CABLES. Burns, R. S.; De Lorenzo, J. T. (Oak Ridge National Lab., Tenn. (USA)). 1975. 17p. Dep. NTIS $4.50.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

Radio-frequency signals simulating electrical interference ranging from 50 kHz to 50 MHz were applied to the shields of the input cable system (two solid-shielded, mineral-insulated cables approximately 6 m long) of a wide-band (approximately 60 MHz) differential preamplifier for use with fission counters as input devices as part of in-vessel, low-level flux monitors in future liquid-metal fast breeder reactors (LMFBRs) to determine the common-mode rejection. Results show that differences in electrical properties and shielding characteristics of the two input coaxial cables along with end effects produced by an unbalanced sensor severely degrade the rejection capability of the differential preamplifier. At 1 MHz, the common-mode rejection without input cables is approximately -70 dB; this is reduced to approximately -10 dB when measured with the rf signal applied to the surface of the input cable shields. Measurements of the shielding characteristics of the input cables showed resonances at test frequencies greater than 2 MHz. A ferrite core was installed in the input assembly to increase the impedance of the shields and to permit termination of the coaxial line consisting of the input cable shields and the protective metal conduit for the input cables. This assembly eliminated all resonances below 20 MHz. The increased impedance also reduced the amplitude of the shield currents, resulting in an increase in the shielding effectiveness of the input cables without affecting the signal transmission of the cables. (auth)

7362 (CONF-751116-7) DESIGN OF OPTIMIZED RC-CR FILTERS FOR CURRENT-PULSE OPERATION OF FISSION COUNTERS AND HIGH SENSITIVITY FISSION COUNTERS FOR HIGH GAMMA BACKGROUNDS. DeLorenzo, J. T. (Oak Ridge National Lab., Tenn. (USA)). 1975. 36p. Dep. NTIS $5.00.

From nuclear science symposium; San Francisco, California, USA (19 Nov 1975).

A calculational procedure was developed to design RC-CR filters for processing current pulses from fission counters in a gamma background ranging from 10^5 to 6×10^6 R/hr. The effects of noise from the gamma background and the input preamplifier and of the time constant of the fission counter and input cable were studied. Analytical results were in close agreement with experimental data. A pole-zero network was examined as a means of compensating for the time constant of the fission counter and input cable, but its improvement was insignificant. The procedure was expanded to design a high sensitivity, gamma-tolerant fission counter (approximately 10 counts sec^{-1} nv^{-1} at 10^5 R/hr), and the result was a conceptual design with a performance almost equal to a recently developed high temperature fission counter. (auth)

7363 (EGG-1183-1635) CALIBRATION OF XRDs FOR PHOTON ENERGIES BELOW ONE KILOVOLT. Singman, L. (EG and G, Inc., Las Vegas, Nev. (USA)). 10 Jun 1974. 18p. Dep. NTIS $4.00.

Several windowless XRD x-ray detectors have been calibrated at x-ray photon energies below 1 keV. Three spectral lines were used in the calibration: Ck alpha (279 eV), FeL alpha (705 eV) and CuL alpha (926 eV). The lines were generated by a Henke x-ray tube utilizing the characteristic radiation of the appropriate anode material. About 95 percent spectral purity was achieved by a combination of x-ray tube operation at the lowest possible voltage and by filtering. The intensities were measured with an ionization chamber filled with argon at pressures of 50 and 100 mm Hg. The windows for the x-ray tube and ionization chamber consisted of aluminized polycarbonate film. The resulting detector sensitivities approximately fitted the absorption curve for gold. (auth)

7364 (EGG-1183-2329) CAPABILITIES OF MERCURIC IODIDE AS A ROOM TEMPERATURE X-RAY DETECTOR. Slapa, M.; Huth, G. C.; Seibt, W.; Tove, P. A.; Schieber, M. M.; Randtke, P. T. (California Univ., Los Angeles (USA). Lab. of Nuclear Medicine and Radiation Biology; Uppsala Univ. (Sweden); EG and G, Inc., Goleta, Calif. (USA)). Oct 1975. 9p. (CONF-751146-1). Dep. NTIS $4.50.

From conference of the IEEE; San Francisco, California, USA (20 Nov 1975).

Measurement results obtained with HgI_2 detectors at room temperature in the low energy x-ray region down to 2 keV are reported. The best resolution obtained is 548 eV for 5.9 keV x-rays, and the 2.01 keV phosphorous x-ray line has been resolved with a detector with an area of 14 mm^2. The optimization of the detector-amplifier system and polarization effects in the detectors are discussed. (auth)

7365 (JUL-1186) SIMPLE METHOD OF ABSOLUTE DETERMINATION OF THE DECAY RATE OF ^{60}Co, ^{46}Sc, ^{24}Na, AND ^{56}Co ACTIVATION DETECTORS USING $4\pi\beta$-γ COINCIDENCE MEASUREMENTS. Lang, H.; Dieck, E. L. (Kernforschung-

sanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Brennelement- und Bestrahlungstechnologie). Apr 1975. 23p. (In German). INIS.

6 figs.; 10 refs.

A method is proposed to determine the absolute activities of thick ^{60}Co, ^{46}Sc, ^{24}Na, and ^{58}Co probes which are often used as activation detectors for neutron flux, fluency and spectrum measurements. In this method, activity can be measured by a $4\pi\beta$-γ coincidence measurement without an absorber and by a measurement with absorbers of β saturation thickness. As the correction factor of every absolute measurement is determined in the course of the measurement, no additional errors due to varying probe thickness and thus to varying β yield may arise. (GE)

7366 IZMERENIE SPEKTROV NEITRONOV AKTIVATSIONNYM METODOM. (Measurement of Neutron Spectra by Activation Method). Lapenas, A. A. Riga; Izdatel'stvo Zinatne (1975). 112p.

Methods for measuring neutron spectrums in nuclear reactors using an activation method are discussed. The physical and mathematical bases of the activation method are presented, methods for determining spectrums of epithermal, intermediate, and fast neutrons are surveyed, and nuclear constants are presented. The book is designed for physicists working with nuclear reactors and for specialists studying problems of radiation biology, chemistry, and radiation effects on materials. (231 references) (trauth)

7367 DIGITAL RECONSTRUCTION OF POINT SOURCES IMAGED BY A ZONE PLATE CAMERA. Dance, D. R. (Royal Marsaden Hospital, London); Wilson, B. C.; Parker, R. P. Phys. Med. Biol.; 20: No. 5, 747-756(Sep 1975).

Zone plate cameras are used for high sensitivity imaging of X- and γ-ray sources. The image thus obtained requires decoding and numerical techniques have been devised for this purpose. The response function and the signal-to-noise ratio for a single point source have been evaluated for zone plates with varying numbers of zones. Autocorrelation was the best of the methods examined, and the results were in good agreement with those obtained using Monte Carlo techniques. The autocorrelation method could give a gain of 50% in signal-to-noise for a single point source over the maximum obtainable with optical decoding. Criteria for the choice of number of zones are discussed. (auth)

7368 NEW PROPERTIES AND APPLICATIONS OF THORIUM TETRABROMIDE. I. Particle Detector: Response of a $ThBr_4$ Monocrystal to Ne and Ar Ions. Genet, M.; Goby, G.; Husson-nois, M.; Krupa, J. C.; Guillaumont, R. (Univ. of Paris, Orsay, France). Radiochem. Radioanal. Lett.; 23: No. 1, 19-24(15 Oct 1975).

The light output of $ThBr_4$ single crystal was measured as function of the energy of neon and argon ions. The energy was varied with absorbing aluminium foils. Pulse-height analysis of light output shows a linear relation above 3.5 MeV/nucleon. This new heavy scintillator has similar behavior to other ionic scintillators. (auth)

7369 NEW POLY- AND MONOCRYSTALLINE THERMOLUMINOPHORS LiF:CuAg AND LiF:MgTi AND THEIR USE IN CLINICAL DOSIMETRY. Nevyadomski, T.; Ryba, E.; Yasin'ska, M. pp 164-170 of Radiatsionnaya Meditsina. Berkgaut, V. B. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The thermoluminophors LiF:CuAg and LiF:MgTi were prepared and their dosimetric properties were determined. The results obtained for the temperature of maximum thermoluminescence, luminescent spectrum maximum, relative luminescence yield, limitations of measured dose, region of independence on the radiation energy, and standard error of dose measurement are tabulated. The properties of these luminophors embedded in teflon were also determined and the results tabulated. (JSR)

7370 RADIOCARDIOGRAPHY AND REQUIREMENTS PLACED ON THE ELECTRONIC RADIOMETRIC DEVICES. Modestov, V. K.; Gorbushin, N. G.; Eremenko, G. S.; Kaperko, F. F.; Kasatkin, Yu. N.; Mirianashvili, M. L. pp 332-338 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See Conf-681061-P3.

On the basis of an analysis of the requirements placed on electronic radiometric devices in radiocardiography, a three-channel portable clinical radiometer was developed using a scintillation detector. The radiometer is highly sensitive and has a linear response to changes of the output signal in a wide range of radiation intensity. A block diagram of the radiometer and its characteristics are given. (JSR)

7371 METHOD OF (PREVIOUS TO CALIBRATION MEASUREMENT IN A FLUID SCINTILLATION COUNTER) CONVEYING TO A LIQUID SCINTILLATION SYSTEM A PRECISELY FIXED QUANTITY OF RADIOACTIVE SUBSTANCE. Reunanen, M. A. (to Wallac Oy). Swedish Patent 366,394. 1 Aug 1974. 6p. (In Swedish).

A method for introducing a precisely fixed quantity of radioactive substance into a liquid scintillation detector system for calibration purposes is described. (WHK)

7372 DEVICE FOR A CAMERA, FOR EXAMPLE A SCINTILLATION CAMERA, FOR THE RECORDING AND THE DOCUMENTATION OF SIGNALS CONVEYING INFORMATION ABOUT THE POSITION. Larsson, G. A. B. Swedish Patent 361,948. 28 Feb 1974. 14p. (In Swedish)

A scintillation camera for the recording and the documentation of signals conveying information about the position characterized by a radiation detector is described. The camera contains a radiation-sensitive convertor and is of the type that emits a signal "out" that represents the space coordinates for the joint action between a radiation quantum and the convertor; a collimator, which is adjusted on the detector near to the convertor and is made up of a regular set of separate channels for radiation quanta; and a documentation medium and a correction aggregate. (SW)

7373 PRECISION SCANNING WITH ANNIHILATION RADIATION. Oggenfuss, A. Helv. Phys. Acta; 48: 26-29(1975). (In German)

The almost exact 180° correlation of the quanta emitted in the 2 γ decay of positrons makes it possible to measure the spatial distribution of β^+-active materials with high precision. The limitations of the position resolution of this method (using a device called an A scanner) and advantages of the method with respect to the conventional one-quantum scanner are indicated. The solid angles obtained with both types of scanners are compared to show that the A scanner gives a very sharp peak in comparison with the broad diffuse line forms obtained with the one-quantum scanner. The effect of the medium on the values obtained are illustrated. (JSR)

7374 STANDARDIZATION OF PORTABLE RADIATION MONITORS. Davydov, A. V.; Guseinov, A. M.; Emel'yanov, N. N. Meas. Tech. (USSR) (Engl. Transl.); 18: No. 5, 751-754(May 1975).

Translated from Izmer. Tekh.; 18: No. 5, 71-73(May 1975).

Numerous different radiometers are in use in locating and exploiting radioactive mineral deposits, which perform gamma surveys at the Earth's surface, gamma surveys in drilled holes, processing of drilled cores, logging in shallow boreholes, gamma-ray testing on samples, and so on. Examples are the RPP-1 prospecting radiometer, the SRP-2 scintillation radiometer, and the PRKS borehole logging radiometer. Although the tasks vary greatly, as do their design features, these instruments all have much in common, namely they all record the mean count rate from a random time distribution on pulses from ionizing-radiation detectors. This means that there is substantial scope for unifying these instruments and reducing the range of necessary units. A standard system is proposed. (WHK)

Radiation Dosimeters

Refer also to abstract 7480.

7375 (AED-CONF-75-141-015) RESULTS OF THE PTB DOSEMETER COMPARISON SERVICE WITH CHEMICAL DOSEMETERS. Feist, H. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany)). 1975. 4p. (In German). INIS.

From 6th scientific symposium of the Deutsche Gesellschaft fuer Medizinische Physik; Berlin, F. R. Germany (28 Apr 1975).

5 refs. With abstract.

Twice annually, the PTB makes a comparison with iron sulfate dosemeters for dosemeters being used at Co-60 sources and electron accelerators. A total of about 500 dosemeters in the form of glass ampoules have been irradiated with photons or electrons in the energy range of 1 MeV to 50 MeV in a water phantom so far. What appeared to be a considerable success was that the participants developed a critical attitude towards their own dosimetry methods. (GE)

7376 DETERMINATION OF DOSE RATES OF INCORPORATED β, γ- AND EC, γ-SOURCES WITH A LIQUID SCINTILLA-

TOR. Taegder, K. Hanover; Technische Univ. (1974). 88p. (In German). INIS.

Thesis.

Liquid scintillators can be used to determine the dose rate of (incorporated) radionuclides. The radionuclide the dose of which is to be determined is mixed homogeneously with the scintillator solution. The height of the pulse generated by the scintillator represents the energy per decay absorbed in the measured volume. After energy calibration of the detector, the dose rate can be determined with the aid of the pulse height spectrum with an error margin of less than 5%. This dosimetrical method has the advantage of monitoring all types of radiation generated during decay, i.e. X-ray, β- and γ-radiation, auger and conversion electrons. So far, it is not applicable to chromium 51 which generates X-ray quanta and auger electrons of only about 5 keV. This method of measurement was developed with special regard to the study of radionuclides to be used in nuclear medicine. The measuring volume with the tissue-equivalent scintillator represents an organ phantom. The traditional dose calculations call for an exact knowledge of the decay schemes, while the decay schemes of nuclides with complex decay are usually not known. For the method described, no knowledge of nuclear physical data is necessary. The mean absorbed energies per decay, or rather the mean dose rates, were determined experimentally for Cr-51, Se-75, Br-82, Sr-85, In-111, I-131, Hg-197, Au-198, and Hg-203 and then compared with the values calculated by the Monte-Carlo method. (GE)

7377 CALCULATION AND MEASUREMENT OF THE CHARACTERISTICS OF THE MEDICAL-BIOLOGICAL BEAM OF THE ITEP (INSTITUTE OF THEORETICAL AND EXPERIMENTAL PHYSICS). Blokhin, S. I.; Gol'din, L. L.; Kleinbok, Ya. L.; Lomanov, M. F.; Khoroshkov, V. S. pp 170-174 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The dose field of the proton beam of the ITEP synchrotron was measured with ionization chambers and thermoluminescent dosimeters and the results obtained were compared with calculations made by other authors. The results showed that the calculation of the dose field by numerical integration of the ionization loss gives a completely satisfactory precision for practical purposes. (JSR)

7378 STUDY AND DEVELOPMENT OF DETECTORS BASED ON THE EFFECTS OF SOLIDS AND THEIR USE IN THE CLINICAL DOSIMETRY OF IONIZING RADIATION. Varin, N.; Volkov, V. A.; Epishev, V. G.; Kalantarov, K. D.; Kuznetsov, V. A.; Li Don Khva; Mandel'tsvaig, Yu. B.; Tabarovskii, I. K. pp 177-181 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

In recent years special attention has been devoted to the development of solid state detectors for dosimetric purposes. The basic characteristics of scintillation, semiconductor, and integrating luminescence detectors are reviewed. The basic parameters of specific detectors of these types developed in the USSR are tabulated and briefly discussed. (JSR)

7379 GAMMA DOSIMETRY WITH SEMICONDUCTOR DETECTORS. Denisenko, O. N.; Il'ichev, B. V.; Kozlov, V. A. pp 185-187 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A gamma dosimeter was developed in which the linearity of response was obtained by inclusion of a detector of the solar element type in a short-circuit regime. The principal circuit of the dosimeter is given and its principal characteristics are briefly discussed. (JSR)

7380 INTERNATIONAL WORK ON THE METROLOGY OF IONIZING RADIATION. Yudin, M. F.; Bregadze, Yu. I. Meas. Tech. (USSR) (Engl. Transl.); 18: No. 4, 535-537(Apr 1975).

Translated from Izmer. Tekh.; 18: No. 4, 39-40(Apr 1975).

A historical review on international coordination on ionizing radiation units and measurements is given. (WHK)

7381 VISUAL COLOR INDICATORS FOR DOSES OF IONIZING RADIATION. Vainshtok, B. A.; Generalova, V. V.; Gurskii, M. N.; Krasovitskii, B. M. (to All-Union Scientific-Research Inst. of Monocrystals). Danish Patent 155,273. 28 Oct 1974. Filed date 21 Mar 1973. 9p. (In Danish)

Radiochromic dye dosemeters based on non-halogenated polymer film containing luminescent dye of triarylpyrazoline derivatives were fabricated. To measure 0.2 to 5.0 Mrad, 5 to 30 Mrad, 5 to 70 Mrad doses polystyrene, patymethylmelhacrylate and cellulose do- or tri-acetate films respectively were used, all containing R^1, R^2, R^3 - triarylpyrazoline, where R^1 and R^2 were phenyl radicals and R^3 was a arylimidazol radical. As additives halogenated hydrocarbons were used. (DE)

7382 COSMIC RAY PARTICLE DOSIMETRY AND TRAJECTORY TRACING. Cruty, M. R.; Benton, E. V.; Turnbill, C. E.; Philpott, D. E. (Univ. of California, San Francisco). Aviat., Space Environ. Med.; 46: 537-552(Apr 1975).

Five pocket mice (Perognathus longimembris) were flown on Apollo XVII, each with a solid-state (plastic) nuclear track detector implanted beneath its scalp. The subscalp detectors were sensitive to HZE cosmic ray particles with a LET greater than or approximately equal to 0.15 million electron volts per micrometer (MeV/micron). A critical aspect of the dosimetry of the experiment involved tracing individual particle trajectories through each mouse head from particle tracks registered in the individual subscalp detectors, thereby establishing a one-to-one correspondence between a trajectory location in the tissue and the presence or absence of a lesion. The other major aspect was the identification of each registered particle. An average of 16 particles with Z greater than or equal to 6 and 2.2 particles with Z greater than or equal to 20 were found per detector. The track density, 29 tracks/sq cm, when adjusted for detection volume, was in agreement with the photographic emulsion data from an area dosimeter located next to the flight package. (auth)

Nuclear Spectroscopic Instrumentation

Refer also to abstracts 6912, 8190, and 8511.

7383 (KFK-2046, pp 33-50) FAST NEUTRON CAPTURE CROSS SECTION FACILITY AT CADARACHE. Le Rigoleur, C.; Arnaud, A. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

6 figs.; 1 tab.; 6 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

The total energy weighting technique has been applied to measure absolute fast neutron capture cross section at Cadarache. We use a non hydrogeneous liquid scintillator to detect the gamma from the cascade. The neutron flux is measured with a B^{10} NaI(Tl) detector of Li^6 glass scintillator of well known efficiency. The time of flight technique is used with on-line digital computer data processing. (auth)

7384 SOLUBILIZED LIQUID SCINTILLATOR FOR BETA SPECTROMETRY AND GAMMA DOSIMETRY OF UNIFORMLY DISTRIBUTED GAMMA SOURCES IN AQUEOUS SOLUTIONS. Lahmann, W. Hanover; Technische Univ. (1974). 51p. (In German). INIS.

Thesis.

The detection and the spectrometry of β-radiation in aqueous solutions by the scintillation counting technique is studied with a water fraction (30-100%) high enough to bar the use of the scintillators otherwise customarily employed. The following possibilities are investigated and delineated in terms of their applicabilities: (1) Cherenkov count; (2) emulsion count (emulsification of a liquid scintillator); and (3) micelle count (solubilization of a liquid scintillator). The third possibility turns out to be highly suitable: even with 75 vol. % of water in the bulk quantity the detection of β-radiation is still possible with a high counting yield (with the exception of low energy radiation, as in the case of ^3H). The performance capability of micelle counting is demonstrated by the example of a measurement for gamma dosimetry in water; this is the first measurement of gamma dose with a uniformly distributed gamma emitter. (GE)

7385 ANOMALOUS REFLECTION IN A NEUTRON TRIPLE-AXIS CRYSTAL SPECTROMETER. Maliszewski, E.; Sosnowski, J.; Bednarski, S. (Inst. of Nuclear Research, Warsaw). Acta Crystallogr., Sect. A; 31: No. 4, 523-525(1 Jul 1975).

The origin of the anomalous peaks occurring in a neutron crystal spectrometer is explained by the use of reciprocal-space geometry. The anomalous peaks are due to Bragg reflexion in the sample of the incident neutrons with wavelengths different from the central value of the nominally monochromatic beam. (auth)

7386 RESOLUTION OF SLOW-NEUTRON SPECTROMETERS. IV. The Triple-Axis Spectrometer Resolution Function, Spatial

Effects Included. Popovici, M. (Inst. of Atomic Physics, Bucharest). Acta Crystallogr., Sect. A; 31: No. 4, 507-513 (1 Jul 1975).

The procedure for computing the resolution function of triple-axis spectrometers is reformulated to make allowance for the spatial configuration of the experimental set-up and for the curvature of the monochromator and analyzer crystals. Simple formulae are given for computing the resolution function of conventional instruments as well as of spectrometers with focusing crystals. (auth)

High Energy Physics Instrumentation

7387 (FSU-HEP--75-6-5) IONIZATION IDENTIFICATION OF CHARGED PARTICLES IN BUBBLE CHAMBER EXPERIMENTS. Rauchwarger, K. A. (Florida State Univ., Tallahassee (USA)). Jun 1975. 42p. Dep. NTIS $5.00.

Thesis.

A computer program has been developed which identifies charged particles from bubble chamber photographs by comparing the pulse height information from an automatic measuring device (The Spiral Reader) to an expected ionization of various mass charged particles. Of all identifiable tracks made by charged particles of momentum below 1500 MeV/c, 70 percent were identified correctly, 28 percent could not be identified and 2 percent were incorrectly identified. Since a kinematical analysis takes precedence over ionization identification, only 16 percent of all events needed to be sent to human operators for identification. The identification programs in misidentification of 2 percent of all identifiable tracks correspond to less than 1 percent of all events being incorrectly identified. (auth)

7388 VERTEX SPECTROMETER OF THE MULTIPARTICLE ARGO SPECTROMETER SYSTEM AT BNL. Schuebelin, P. (Brookhaven National Lab., Upton, NY); Ramanauskas, A.; Turkot, F.; Collins, G. B.; Ficenec, J. R.; Gilbert, D. R.; Schreiner, W. N.; Stringfellow, B. C.; Trower, V. P. pp 375-379 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale de Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868--.

The need for definitive studies of high multiplicity, high momentum transfer reactions in the 30 GeV energy range prompted the construction of a Vertex Spectrometer (VS) which combines the large solid angle advantage of a bubble chamber with the triggerability and digitized readout capability of an electronic system which was used as an integral part of the Multiparticle Argo Spectrometer System (MASS) at Brookhaven in an experiment which studied pp interactions at 28.5 GeV/c. The VS consists of a nested set of 9 cylindrical wire spark chambers surrounding a 20 cm long hydrogen target located in a ten kG magnetic field. The field volume measures $1.5 \times 1 \times 1$ m^3. The chambers have radii varying from 15 cm to 47 cm with an active height of 74 cm. The axis of the cylinders is perpendicular to the beam. Dip angles of ±50° in respect to the beam are covered. High multiparticle efficiency is accomplished by pulsing the chambers in a transmission line mode. Digitization is obtained by means of magnetostrictive lines located inside the magnet and shielded from the ten kG field. (WHK)

Radiometric Instruments

Refer also to abstracts 7296 and 7314.

7389 (AED-CONF-75-290-001) DESIGN AND OPERATION OF DUST MEASURING INSTRUMENTATION BASED ON THE β-RADIATION METHOD. Lilienfeld, P. 1975. 29p. INIS.

From International conference on dusts and gases at the working site; Bonn-Bad Godesberg, F. R. Germany (18 Jun 1975).

4 figs.; 2 tabs.; 29 refs. With abstract.

The theory, instrument design aspects and applications of β-radiation attenuation for the measurement of the mass concentration of airborne particulates are reviewed. Applicable methods of particle collection, beta sensing configurations, source (^{63}Ni, ^{14}C, ^{147}Pr, ^{85}Kr) and detector design criteria, electronic signal processing, digital control and instrument programming techniques are treated. Advantages, limitations and error sources of β-attenuation instrumentation are analyzed. Applications to industrial dust measurements, source testing, ambient monitoring, and particle size analysis are the major areas of practical utilization of this technique, and its inherent capability for automated and unattended operation provides compatibility with process control synchronization and alarm, telemetry, and incorporation into pollution monitoring network sensing stations. (auth)

7390 APPLICATION OF POLYCHROMATIC X-RADIATION FOR DENSITY MEASUREMENTS. Mueller, R. Aachen; Technische Univ. (1974). 88p. (In German). INIS.

Thesis.

In this study a theory is postulated by means of which quantitative calculations can be made for density measurements by polychromatic X-rays. At the same time, gas densities for the first time were measured qualitatively by means of focused X-rays. The use of polychromatic X-rays allowed the application of low tube voltages, but high intensities. The disadvantages of the electron beam method, i.e., dependence on molecular bonding and excitation states of the electron absorption and the spectral intensity, and failure in the case of electrically conducting absorbers, are avoided by the X-ray technique. (GE)

7391 STANDARD MEASURES OF SURFACE DENSITY FOR TESTING AND CALIBRATING RADIOISOTOPE THICKNESS GAUGES. Karmalitsyn, N. I.; Tutane, Z. A. Meas. Tech. (USSR) (Engl. Transl.); 18: No. 5, 680-681(May 1975).

Translated from Izmer. Tekh.; 18: No. 5, 30-31(May 1975).

Methods and the use of standard samples for calibrating radioisotope thickness gages are briefly discussed. (WHK)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to abstracts 7173, 7174, and 8207.

7392 EVALUATION OF THE EFFECT OF THE SPACE ENVIRONMENT ON MATERIALS. Conference Held at Toulouse France, June 17–21, 1974. Paris; Centre National d'Etudes Spatiales (1974). 891p. (In French and English)

Papers are presented dealing with measuring techniques for the investigation of the effects of space contamination in semiconducting and nonsemiconducting materials. Questions of standardization are considered, and simulation techniques are described. Some of the topics covered include radiation shielding for quartz crystals in satellites, calculation of environmental fluxes and doses absorbed on the Geos satellite, Jupiter's radiation belts and their effects on spacecraft, simulation of the cosmic dust and micrometeorite particle streams, reduction of silicone outgassing by purification, emittance of certain hygroscopic thermal control coatings, simulation of the cosmic corpuscular radiation effects on optical materials, and radiation effects on high-efficiency silicon solar cells. (IAA)

7393 RADIATION EFFECTS ON SECOND SURFACE MIRRORS. Fogdall, L. B.; Cannaday, S. S. (Boeing Co., Seattle). pp 549-560 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974).

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

The results of an evaluation of fused silica/silver mirrors, used for spacecraft temperature control, under conditions of simulated space environments are examined. Particular attention is given to the spectral reflectance and absorptance of the mirrors, the radiation resistance of fused silica. Tests showed that by outgassing at hot mirrors, RTV silicon adhesives can contaminate adjacent reflective surfaces. Repolymerization of silicon also may occur under the influence of radiation, resulting in changes in the thermophysical properties of test samples, which may affect appropriate simulation. It is shown that fused silica itself is stable in a space environment, but that stability and performance of fused silica mirrors may be degraded by the presence of organic materials near the mirrors. (IAA)

Miscellaneous Instruments

Refer also to abstracts 8676, 8727, and 8734.

7394 (GERHTR-117) INFLUENCE OF THE METHOD OF MEASUREMENT ON THE OPTICAL ANISOTROPY FACTOR OPTAF OF PYROCARBON. Koizlik, K.; Taeuber, K.; Nicke, H.; Wasmund, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jul 1974. 35p. Dep. NTIS $5.00.

Work performed under United States–German High Temperature Reactor Research Exchange Program.

This study describes the development and installation of an automatic microscope photometer for the measurement of the optical anisotropy factor OPTAF on the pyrocarbon coatings of fuel particles. After a short representation of the physical basis of this procedure the new microscope photometer is introduced. First measurements for the adaptation of the new instrument of the so far used microscope photometer are discussed. By these measurements the influence of the instrument on the value of OPTAF in the case of some special ways of measuring are explained and the appearance of an apparent anisotropy is interpreted. (auth)

7395 (UCID-16937(Pt.2)) AUTOMATIC RADIOCHEMICAL GAS-SEPARATION SYSTEM DEVELOPMENT. Part 2. System Components. Adams, T. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Oct 1975. Contract W-7405-Eng-48. 23p. Dep. NTIS $4.00.

The automatic gas separation system is designed to automatically select an appropriate size sample, perform the desired separation and pertinent calculations, present real-time analytical results, and recover the purified sample constituents. The separations are accomplished by elution chromatography with a computer for command and control. A functioning semiautomatic prototype has been constructed. A detailed description of each component of the system is given. A general description of the design, operating procedure, and status of the system appeared in Part 1 of this series. (auth)

7396 TEMPERATURE MEASUREMENT. III. Instruments and Apparatus. New York; American Society of Mechanical Engineers (1974). 138p. $16.00.

Guidelines for the selection, installation and use of radiation thermometers, thermocouple thermometers, resistance thermometers, liquid-in-glass thermometers, filled system thermometers, optical pyrometers, and bimetallic thermometers are given. The recommended temperature ranges and detailed calibration procedures are given. (WHK)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

7397 (CONF-750968-1) PREPARATION OF TARGETS USING AN ISOTOPE SEPARATOR. Tracy, J. G.; Dagenhart, W. K. (Oak Ridge National Lab., Tenn. (USA)). 1975. 14p. Dep. NTIS $4.00.

From 4th annual international conference of the Nuclear Target Development Society; Argonne, Illinois, USA (29 Sep 1975).

The 180° Oak Ridge Sector Isotope Separator (ORSIS) is used for preparing enriched isotopic ion-implanted targets. The ORSIS and receiver and their operation in target preparation are described. Assays of ORSIS targets (^{156}Dy, ^{158}Dy, ^{162}Er, ^{164}Er, ^{154}Gd) are compared with these for calutron separations. (DLC)

Isotope Separation (Industrial)

Refer also to abstracts 6967 and 7267.

7398 (AECL-5035, pp 10-16) HEAVY WATER PRODUCTION AND COMPUTER SIMULATION. Miller, A. I. (Chalk River Nuclear Labs., Ont.). Win 1975.

In AECL research and development in engineering. (Atomic Energy of Canada Ltd., Chalk River, Ontario).

Heavy water production is a new technology in Canada. Plants many times larger than any previous one were constructed and brought into operation in a remarkably short time. Computer simulation of the plants helps accelerate the heavy water production program. (auth)

7399 (AECL-5248) CANADIAN HEAVY WATER SITUATION. Dahlinger, A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1975. 9p. (CONF-750699-1). Dep. NTIS (US Sales Only) $4.50. AECL $0.50.

From 15th annual international conference; Ottawa, Canada (15 Jun 1975).

Existing heavy water plants in Canada are producing at a satisfactory rate and currently planned capacity is in balance with projected needs. By 1980, there will be Girdler-Sulphide plants installed with a design capacity of almost 600 kg/h. Effort is required to minimize production costs for heavy water and to ensure that costs do not increase faster than the current inflationary trend. (auth)

7400 (COO--3581-3) STABLE ISOTOPE STUDIES. Progress Report, August 1, 1974-July 31, 1975. Flynn, G. W.; Hsu, D.S.Y.; Preses, J.M.; Spindel, W.; Weston, R.E. (Yeshiva Univ., New York (USA). Belfer Graduate School of Science). 31 Jul 1975. Contract AT(11-1)-3581. 37p. Dep. NTIS $5.00.

Progress is reported in the following studies: selective two-step laser-induced photodissociation, unimolecular processes induced by multiple-photon absorption, and vibrational energy transfer processes involving isotopic species of sulfur dioxide. These laser-induced chemical reactions can possibly be applied to isotope separation. (LK)

7401 (K-L-6353) ENRICHMENT: THE CURRENT STATUS AT OAK RIDGE, PORTSMOUTH, AND PADUCAH. Wilcox, W. J. Jr.; Bradbury, J. T. (Oak Ridge Y-12 Plant, Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 29p. (CONF-751101-52). Dep. NTIS $5.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

Expansion of the diffusion plants is discussed in detail. Other enrichment processes, particularly the gas centrifuge process, are mentioned briefly. (LK)

7402 (RT/ING-(75)12) THERMAL DIFFUSIVITY MEASUREMENT WITH PULSE TECHNIQUE. Ferro, C. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jun 1975. 48p. (In Italian). Dep. NTIS (US Sales Only) $5.00.

Two problems have arisen during the performance of our experiments on thermal diffusivity: (1) The need of an analytical tool capable of evaluating the influence of some parameters on temperature transient. (2) The necessity of determining the thermal diffusivity from different points of the experimental curve. The report deals with these problems. The programs utilized are reported together with some results obtained. (auth)

7403 (UCRL-52000-75-10, pp 1-10) HEAVY WATER PRODUCTION: NEW LLL STUDIES. Oct 1975.

In Lawrence Livermore Laboratory energy and technology review. (California Univ., Livermore (USA). Lawrence Livermore Lab.).

Studies of methods for producing heavy water on a large scale are described. The basic goal is a threefold reduction in U.S. production costs (currently $125 to 135/kg). The heavy water inventory in heavy water reactors now accounts for 20 to 30 percent of their total cost. The four advanced technologies being studied include: (1) isotopically selective single-step photodissociation, which capitalizes on differences in the optical absorptivity of normal and deuterated species to effect large isotopic selectivities in photochemical decomposition reactions; (2) isotopically selective two-step photolysis, which couples isotopically selective vibrational excitation of the desired species with radiative raising of the energy of the excited molecules to near their dissociation edge, from where isotopically selective chemical decomposition occurs; (3) isotopically selective photodesorption, which uses low-energy photons to induce isotopically selective desorption of molecules from transparent surfaces; and (4) metallic chromatographic separation, by which deuterium is separated from protium by displacement chromatography in a column packed with an intermetallic compound of, for example, a rare earth and a transition metal. Theoretically, each of these processes offers the potential for a considerable savings in heavy water production costs. The plan is to continue investigating each until a clear choice can be made of which process to pursue through pilot-plant construction. (TFD)

7404 CONTRIBUTION TO THE THEORY OF MULTI-COMPONENT ISOTOPE SEPARATION AND ITS APPLICATION ESPECIALLY IN THE FIELD OF RESEARCH ON U-236 PRODUCTION IN THE FUEL CYCLE. Mueller, F. J. Aachen; Technische Univ. (1975). 141p. (In German). INIS.

Thesis.

As an introduction, the gas diffusion process and constructional principle of separating plants for ^{235}U enrichment working by this method are briefly explained. On the basis of the separation of binary isotope mixtures, the theory of multicomponent mixtures is demonstrated and modified with regard to specific problems. Its ranges of application are described and illustrated by examples. Production, loss, and processing of the ^{236}U generated mainly by neutron capture are described, and the future impact of ^{236}U in the fuel cycle is analyzed from the point of view of nuclear economy. (GE)

Isotopic Power Sources

7405 (AE-506) STUDY OF A TRITIUM-FUELED BATTERY UTILIZING THE DIFFERENCE OF WORKFUNCTION BETWEEN ELECTRODES. Braun, J. (Aktiebolaget Atomenergi, Studsvik (Sweden)). Sep 1975. 20p. Dep. NTIS (US Sales Only) $4.50.

A device with two plane parallel electrodes, one impregnated with tritium and the other made of a material with a different work function, the interspace being filled with a noble gas (argon) has been used as a battery. The open circuit voltage is mainly determined by the choice of electrode material and is of the order of 1 V. The short-circuit current and the collection efficiency are found from the asymptotic solutions to the ion and electron equations coupled by Poisson's equation. (auth)

7406 (ORNL-TM-4908) COMPATIBILITY OF $^{244}Cm_2O_3$ WITH CONTAINMENT MATERIALS FOR ELECTRIC POWER GENERATOR SYSTEMS. DiStefano, J. R. (Oak Ridge National Lab. Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 60p. Dep. NTIS $5.45.

Curium-244 sesquioxide has many properties that makes it attractive as a heat source in electric power generator systems. Current radioisotopic thermoelectric generator designs generally specify fuel-containing interface temperatures from 800 to 1400°C. Results of compatibility tests of $^{244}Cm_2O_3$ with a variety of materials are reported. Test conditions included 5000 h at 900 and 1400°C, 2500 h at 1100°C, and static helium and dynamic vacuum environments. Materials included graphite, ThO_2, superalloys, noble metals, and refractory metals. (auth)

7407 (SC-PR-67-837) SPACE ISOTOPE POWER PROGRAM, Quarterly Report, July--December 1967. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1967. 62p. Dep. NTIS $5.50.

Declassified 3 Mar 1975.

Progress during July to October 1967 in the Space Isotope Power Program at Sandia Laboratories is reported. (LCL)

7408 (SC-PR-67-3023) SANDIA LABORATORIES QUARTERLY REPORT AEROSPACE NUCLEAR SAFETY PROGRAM, OCTOBER 1-DECEMBER 31, 1967. Illing, R. G. (comp.). (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1968. 80p. Dep. NTIS $6.00.

Declassified 20 Oct 1975.

Research, development, support, and test activities in the Sandia Laboratory Aerospace Nuclear Safety Program from October 1 to December 31, 1967 are described. (auth)

7409 (SC-PR-69-20) SPACE ISOTOPE POWER PROGRAM. Quarterly Report, October--December 1968. (Sandia Labs., Albuquerque, N. Mex. (USA)). Feb 1969. 56p. Dep. NTIS $5.50.
Declassified 2 Nov 1971.
Progress during October through December 1968 in the Space Isotope Power Program at the Sandia Laboratories is reported. (LCL)

7410 (SC-RR-66-20) DISCUSSION OF PROBLEM AREAS WITH RESPECT TO A $SrBr_2.H_2O$ FUEL IN A SNAP ISOTOPIC GENERATOR. Wear, J. O. (Sandia Labs., Albuquerque, N. Mex. (USA)). Feb 1966. 11p. Dep. NTIS $4.50.
Declassified 20 Oct 1975.
The use of $SrBr_2 \cdot H_2O$ in place of $SrBr_2 \cdot 6H_2O$ in a SNAP isotopic generator as a concentrated aqueous fuel is discussed. The internal pressure generated at 600°C and the size of a spherical vessel to contain the system is calculated. Vessels weighing 8.21 and 4.26 kilograms are required to hold 1000 grams of ^{90}Sr in the forms $SrBr_2 \cdot 6H_2O$ and $SrBr_2 \cdot H_2O$, respectively. With 100 percent ^{90}Sr assumed, the power densities are 0.575 and 1.15 watts per cubic centimeter for $SrBr_2 \cdot 6H_2O$ and $SrBr_2 \cdot H_2O$, respectively. The possibility of problems with all ^{90}Sr isotopic generators, because of daughter product formation, is considered briefly. (auth)

Radiation Sources

Refer also to abstract 6932.

7411 OPTIMUM NUMBER OF RADIATION SOURCES FOR DISTANCE RADIOTHERAPY. Nikeshichev, V. N.; Sinitsyn, R. V. pp 191-196 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)
From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.
The optimum number of radiotherapeutic installations for the USSR is evaluated mathematically and compared with the number of centers presently in operation. (JSR)

Design and Fabrication

Refer also to abstract 7930.

7412 NITROGEN-16 RADIATION SHIELDING UNIT AT THE UNIVERSITIES RESEARCH REACTOR CENTER. Bishop, G. B.; Birchall, I. (Liverpool Univ.). Ann. Nucl. Energy; 2: No. 6, 467-475(Jul 1975).
A source of 6.13 MeV γ photons has been designed in the form of a disc having a dia of 80 cm and a surface activity uniform to ±10%. The photons arise from ^{16}N in the cooling water, activated in the core of the Liverpool and Manchester Universities Research Reactor. The surface exposure rate is in excess of 2 R/hr and a programme of shielding and dosimetry studies is outlined. (auth)

7413 GEOMETRY EFFECT OF A COLLIMATING CHANNEL ON DOSE EXPOSURE. Dol, I. I.; Paramonov, G. K.; Tuchin, V. N. Meas. Tech. (USSR) (Engl. Transl.); 18: No. 5, 755-757 (May 1975).
Translated from Izmer. Tekh.; 18: No. 5, 73-75(May 1975).
Calculations and experimental data are presented that show that the use of cylindrical collimators with a cavity around the radiation source will ensure a lower contribution of the radiation scattered in the collimator material to the radiation dose, in comparison with collimators without a cavity. (WHK)

Industrial Uses

Refer also to abstract 6904.

7414 (AED-CONF-75-096-002) APPLICATIONS OF ISOTOPIC MEASUREMENT TECHNIQUES IN THE AUTOMOBILE INDUSTRY. Sailer, S. (Daimler-Benz A. G., Stuttgart (F. R. Germany). Abt. Zentralwerkstofftechnik). 1975. 8p. (In German). INIS.
From meeting of the Deutsche Verband for Materialpruefung; Wuerzburg, F. R. Germany (3 Apr 1975).
3 figs.; 10 refs. With abstract.
A review is given on the most important applications of the isotope measuring technique in the automobile industry. Among these are aerodynamic measurements with krypton 85 to control the ventilation number in the passenger seats, labelling of motor oils with tritium to test the oil consumption as well as the radioactivation of surface layers of certain tools which are subjected to heavy wear in operation. Particularly in the latter case, the isotope proves to be indispensable due to its great sensitivity. A symmetrical activation of a very thin surface layer is a precondition for the method which can be checked by autoradiographic images. (GE)

7415 ISPOL'ZOVANIE RADIOISOTOPNYKH METODOV V PROMYSHLENNOSTI. Opyt Raboty Izotopnoi Laboratorii. (Use of Radioactive Methods in Industry. Operating Experience of the Isotope Laboratory). Lyubchenko, A. P. (ed.). Moscow; Atomizdat (1975). 160p.
Techniques for investigating the physical-mechanical and fine-structure characteristics of materials are presented. They are based on the use of radioactive isotopes as applied to investigating the microdistribution of elements in iron and steel, to the radiochemical analysis of alloys and pure metals, to the determination of diffusion parameters and microimpurities in condensed films, to investigating the wear resistance of steel and iron, and also to following the structure of coatings. (38 figures, 19 tables, and 146 literature references.) (SJR)

7416 RADIOISOTOPE INVESTIGATION OF IMPURITY TRANSPORT IN AIR FLOWS. Gusev, A. A. J. Eng. Phys. (USSR) (Engl. Transl.); 21: No. 1, 906-912(Nov 1973).
Translated from Inzh. -Fiz. Zh; 21: No. 1, 136-144(Jul 1971).
Some problems occurring when radioactive gases emitting β radiation are used as tracers for detecting turbulent diffusion and convection of impurities in air are analyzed. There is no problem associated with differing molecular weights of the radioactive gases and the impurities or the air itself since turbulent diffusion far outweighs molecular diffusion. Four kinds of problems are analyzed, namely: (1) use of the proper integration volume in calculating the proportionality constant between β-particle counts and tracer concentration, (2) the effect of limited range of β-particle detection as well as the failure of an exponential law to rigorously describe β-particle absorption, (3) the effect of details of counter window construction on the number of counts, and (4) the contamination of tracer gases like ^{133}Xe with longer-lived gases like ^{85}Kr. These problems are illustrated by comparison of experimental data with theoretical predictions. (Appl. Mech. Rev.)

LIFE SCIENCES

7417 BIOLOGICAL STUDIES OF COSMIC RAYS. Delahaye, R. P. (Hopital Begin, Val-de-Marne, France); Pfister, A. Rev. Med. Aeronaut. Spat.; 13: 276-283(1974). (In French).

Numerous studies conducted up to the present time on the biological role of cosmic radiation are surveyed. They provide evidence for a beneficial activation effect on organic mechanisms. The influences of heavy particles are, however, difficult to evaluate, and they do not follow classical laws. Lesions which occur depend on the size and speed of the particle and on the amount and type of tissue traversed by it. Moreover, the magnitude of the effect of this nonhomogeneous radiation far exceeds that expected from classical measurements of its dosage strength--i.e., much larger doses are required to experimentally recreate the damage done by this radiation than its doses as measured by conventional equipment. (IAA)

Radiation Effects on Biochemicals

Refer also to abstracts 7460, 7534, and 7545.

7418 (CONF-740379-, pp 223-231) DECOMPOSITION OF ORGANOPHOSPHATE INSECTICIDES BY LIGHT AND BROMINE. Abdel-Wahab, A. M.; Taha, M. I.; Tantawy, M. M. (Assiut Univ., Egypt). 1974.

From symposium on the use of isotopes in pesticides and pest control; Beirut, Lebanon (Mar 1974).

In use of isotopes in pesticides and pest control. (National Council for Scientific Research, Beirut (Lebanon); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt)).

Samples of sumithion, nuvacron, dursban, cyolane and cytrolane are decomposed when exposed to the following: bromine vapour on silica gel chromatoplates, ultraviolet (uv) light in chloroform solutions and N-bromosuccinimide (NBS) in acetone solutions. The effect of uv-light on decomposition of the insecticides is more pronounced than exposure to bromine or treatment with NBS. Sumithion and cytrolane are more affected when exposed to uv-light than dursban, nuvacron and cyolane. Cytrolane is relatively stable when treated with NBS. Exposure of the organophosphates for half-hour to uv-light resulted in an increase in their toxicity compared to the unexposed samples against third instar cotton leafworm larvae. After three hours of irradiation the bioactivity of the compounds decreased slightly except for sumithion and nuvacron which revealed an increase in their toxicity. A further decrease in the potency of most compounds is evident after irradiation for six hours except for nuvacron. (auth)

7419 (COO-3521-4) CHEMICAL AND BIOLOGICAL STUDIES ON NUCLEIC ACIDS AND DERIVATIVES. Progress Report, October 1, 1974-April 30, 1975. Brown, G. B. (Sloan-Kettering Inst. for Cancer Research, New York (USA)). Oct 1975. Contract E(11-1)-3521. 26p. Dep. NTIS $4.50.

Ultraviolet irradiation of N-hydroxyxanthines in the solid state induces a radical that was assigned as an acyl amidogen radical in which the unpaired electron density is partially delocalized throughout the pi-cloud of the purine ring. The radical is reduced in the presence of water. In the presence of methanol this process is also accompanied by some 8-substitution. Photochemical deoxygenation in solution was found to proceed from either the nonionized N-hydroxyl tautomer or the conjugate anion of N-hydroxypurines. Reduction is the sole photoreaction of the former, while intramolecular migration of the oxygen is the main photoprocess of the latter with photoreduction a minor result. The comparison of the photochemistry of the N-hydroxypurine anion to that of the corresponding purine N-oxide was documented with a study of suitable model purine 1-oxides. A unique photorearrangement of 1-hydroxyxanthine to the oncogenic 3-isomer was examined and is deduced to be a two step process. (auth)

7420 EFFECT OF IONIZING RADIATIONS AND HEAT ON THE HORSERADISH PEROXIDASE. Excerpt. Delincee, H. Munich; Technische Univ. (1972). 15p. (In German). INIS.

Thesis.

A monomeric isoenzyme mixture was irradiated at 0°C with ^{60}Co γ-radiation at doses of 0.5, 1 and 2 Mrad. In order to investigate the dependence of radiation inactivation on the enzyme concentration, the peroxidase was irradiated as 1.0, 0.5 and 0.1% protein solution. The determination of the total activity gave an exponential slope for the radiation inactivation. The required radiation dose for inactivation decreases with falling enzyme concentration. The thin layer isoelectric focussing (DIEF) of the 1% irradiated peroxidase solution, exhibits a strongly modified isoelectric pattern. There was a distinct difference in the inactivation of the single isoenzymes. The thin layer gel filtration clearly showed that enzymatically active aggregates occur with irradiation whose activity increases with increasing dose. The monomers obtained by preparative gel filtration and aggregates were separated by means of DIEF and investigated. The conclusions to be drawn from the results regarding the mechanism of the radiation inactivation are discussed. The influence of the gas atmosphere when irradiating (argon, air, N_2O) was investigated. The radiation damage was at its least in an argon atmosphere. The results of the radiation inactivation were then compared with those after heat inactivation. In addition, the effect of a combined heat and radiation treatment was investigated where an additive inactivation effect was found. (GE)

7421 EFFECT OF OXYGEN AND NITROAROMATIC CELL RADIOSENSITIZERS ON RADIATION-INDUCED CLEAVAGE OF INTERNUCLEOTIDE BONDS: ApA, dApA, AND poly(A). Raleigh, J. A.; Kremers, W.; Whitehouse, R. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Radiat. Res.; 63: No. 1, 53-63(Jul 1975).

Irradiation of the dinucleoside monophosphates ApA and dApA in deoxygenated solution leads to a preferential cleavage of the 3' end of the internucleotide bond. Cleavage at the 3' bond is favored to the extent of 2 to 1 over 5' cleavage. Oxygen and nitroaromatic compounds inhibit 3' bond breaking in ApA and dApA in agreement with earlier findings from studies of 3'- and 5'-mononucleotides. In contrast to the mononucleotide results, no enhancement of 5' cleavage is observed for ApA and dApA irradiated in the presence of oxygen or the nitroaromatic additives. The over-all effect of the additives is to decrease the combined (3' and 5') yield of internucleotide bond breaking in ApA and dApA. This phenomenon is also observed for polyadenylic acid in the presence of the nitroaromatics. Oxygen marginally enhances internucleotide bond breaking in polyadenylic acid (factor 1.1) over that seen in deoxygenated solution. Postirradiation alkaline hydrolysis of dApA leads to further ester cleavage revealing the presence of radiation-induced alkali-labile bonds. The number of these bonds decreases in the order oxygen greater than nitrofurans greater than nitrobenzenes approximately irradiation in the absence of additives. (auth)

7422 INFLUENCE OF OXYGEN ON THE YIELD OF DNA DOUBLE-STRAND BREAKS IN X-IRRADIATED ESCHERICHIA COLI K-12. Bonura, T.; Town, C. D.; Smith, K. C.; Kaplan, H. S. (Stanford Univ. School of Medicine, CA). Radiat. Res.; 63: No. 3, 567-577(Sep 1975).

Using a procedure which includes lysis on neutral sucrose gradients containing pronase and detergent with sedimentation at low speeds, we have measured the rate of DNA double-strand breakage by x rays in E. coli K-12 in the presence and absence of oxygen. The number of DNA double-strand breaks increased linearly with dose in both air and nitrogen. The energy required to produce a double-strand break under aerobic irradiation conditions was 532 +- 28 eV and under anoxic conditions 1290 +- 126 eV giving an oxygen enhancement ratio for DNA double-strand breaks of 2.42 +- 0.39. The D_0 values based upon cell killing kinetics were determined to be 2.29 krad for irradiations under aerobic conditions and 6.38 krad for irradiations under anoxic conditions. The resulting oxygen enhancement ratio was 2.79. From these data we have calculated that 1.3 to 1.4 double-strand breaks per genome were produced per lethal event, suggesting that DNA double-strand breaks may play a primary role in the killing of wild-type E. coli K-12 by x irradiation. (auth)

7423 INFLUENCE OF THE lambda PROPHAGE ON THE ACTION OF THE INDUCIBLE INHIBITOR OF POSTIRRADIATION DNA DEGRADATION. Polland, E. C.; Randall, E. P.; Keller, K. M.; Boyce, R. P. (Pennsylvania State Univ., University Park). Radiat. Res.; 63: No. 3, 553-559(Sep 1975).

Early observations on the inducible inhibitor of postirradiation DNA degradation involved cells of Eschericia coli which carried either prophage or defective prophage. The question as to whether the prophage element is essential can be answered by observing the induction of inhibition in cells which (a) carry the prophage and can be induced or do not have the prophage and (b) carry the prophage but can not be induced. The strains used are AB1157 and AB1157gamma/sub ref/; AB2463(recA$^-$) and AB2463gamma /sub ref/; AB2494(lex$^-$) and AB2494gamma/sub ref/. The results indicate that, while the presence of an inducible prophage does modify the postirradiation DNA degradation, it is not essential; inhibition occurs in its absence. On the other hand a prophage in a cell where induction is absent or minimal does not confer the

property of inhibition. The inducible inhibitor is therefore a property with characteristics similar to phage induction but not the same as phage induction. (auth)

7424 DEGRADATION OF DNA IN HAEMOPHILUS INFLUENZAE CELLS AFTER X-RAY IRRADIATION. I. Experimental Results. Randolph, M. L.; Setlow, J. K. (Oak Ridge National Lab., TN). Biophys. J.; 15: No. 5, 441-453(May 1975).

Sequential measurements of DNA in Haemophilus influenzae cells after x-ray irradiation show rapid initial degradation of DNA followed by a plateau after about 40 min at normal growth conditions. Both the initial rate and final amount of degradation increase with radiation exposure. Degradation is somewhat greater in stationary-phase than in log-phase cells, but colony-forming ability (CFA) is independent of cell stage. Distributions of single-strand lengths of DNA in unirradiated or irradiated cases, as measured by alkaline sucrose gradient techniques, are neither monodispersive nor random, and possible causes for nonrandomness are discussed. The energy dissipated in the DNA is estimated as 40 to 50 eV per single-strand break for log-phase cells. The fractions of initial DNA remaining in heavily irradiated cells after long incubation are much greater than either the residual CFA or the number of DNA strands free of breaks. Hence, we conclude that cellular degradation of DNA, after exposure to ionizing radiation, cannot be explained quantitatively or qualitatively by simple correlations to these measures of cellular damage, but rather requires a more complex theory. (auth)

7425 POSTREPLICATION REPAIR OF ULTRAVIOLET DAMAGE TO DNA, DNA-CHAIN ELONGATION, AND EFFECTS OF METABOLIC INHIBITORS IN MOUSE L CELLS. Fujiwara, Y. (Kobe Univ., Japan). Biophys. J.; 15: No. 5, 403-415(May 1975).

Alkaline sucrose sedimentation studies of DNA from mouse L cells have demonstrated the following effects of several inhibitors of nucleic acid and protein synthesis on postreplication repair of ultraviolet (uv) damage to their DNA. The DNA newly synthesized by a 2 h[^{3}H]thymidine (dThd) label following 254 nm uv irradiation of 20 J/m^2 is made in smaller segments of the number average mol wt (Mn) of approximately 10 x 10^6 than the control of approximately 40 x 10^6. The presence of caffeine at a concentration of 2 mM during the labeling of the irradiated cells reduces the Mn value to 5.8 x 10^6, which is nearly comparable to, but somewhat larger than the expected distance between dimers in parental DNA. Afterwards, such an interrupted DNA made in the irradiated cells is completely repaired to the present maximum Mn value of 40 x 10^6 in the consecutive 4 h chase in unlabeled dThd. The presence of the nucleic acid inhibitor, either 2 mM hydroxyurea, 50 mu M arabinofuranosyl cytosine, 2 mM excess dThd or 5 mu g/ml of actinomycin D (AMD) during 2- to 24-h chase periods after a 2 h postirradiation label prevents the repair to various extents, while 2 mM caffeine completely inhibits it. In the unirradiated cells, these agents except excess dThd and caffeine also interfere severely with normal elongation of nascent DNA made by a 3 min pulse label, but do not appreciably induce single chain breaks of either newly synthesized or parental DNA. The inhibition of the repair by AMD suggests that de novo elongation of DNA to close the gaps in new DNA made in the irradiated cells requires at least a template-dependent DNA polymerase. In contrast, 100 mu g/ml of cycloheximide allows to complete the gap-filling repair, while it simply reduces the rates of chain growth for the repair and normal replication. Therefore, the similar sensitivity of gap-filling repair and normal replication towards the above inhibitors indicates that a preexisting DNA polymerizing system appears to be responsible and to play a common role without new protein synthesis, as far as the repair at early time after uv is concerned. (auth)

7426 NEW POSSIBILITIES OF BIOLOGICAL DOSIMETRY OF IONIZING RADIATION. Kirichinskii, B. R.; Makarchenko, A. F.; Roitrub, B. A.; Baraboi, V. A. pp 361-367 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The possibility of using albumin solutions as a biological dosimeter was investigated. The results showed that the irradiation of solutions of serum albumin with x rays in the dose range from 1 to 1000 kR has no substantial effect on the isoelectric stability of this protein. Sensitizing heating of the irradiated solutions for 30 min at 56° reveals the latent damage to the macrostructure of the protein molecule producing aggregation of the albumin both at the isoelectric point and also at physiological pH conditions, linearly dependent on the radiation dose. This method can be used for the biological dosimetry of radiation. Irradiated and unheated solutions change with dose the intensity of the absorption at wavelengths of 250, 265, and 280 nm at a pH of 7.2. With increase of the pH to 12.0 the wave form is maintained during small radiation doses. In monoiodoacetate–cysteine and adrenaline–acetylcholine systems at the isoelectric point there is an increase of the aggregation process. (tr-auth)

7427 INFLUENCE OF COMPOUNDS PRODUCED BY SUGAR RADIOLYSIS IN THE PRESENCE OF BIVALENT CATIONS ON DNA REPAIR. Haesen, G.; Klein, W. (Forschungszentrum, Seibersdorf, Austria). Stud. Biophys.; 50: 143-149(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

Radiolysis of sugar produces deoxysugars, low molecular weight carbonyls such as malondialdehyde, formaldehyde, glyoxal, organic peroxides and α,β-unsaturated carbonyl sugars. These products of sugar radiolysis are found to be toxic. We performed gradient centrifugations in alkaline sucrose to measure the effect of compounds derived from radiolysis of sugars in regard to DNA-repair. Spleen cells were treated with 1 M glucose and 1 M glucose in the presence of 10^{-4}M Zn^{2+}. These solutions had been previously irradiated with γ-rays up to 2 Mrad. The rejoining of DNA-single-strand-breaks, caused by γ-rays, was measured after 30 minutes of incubation at 37°C. Glucose solutions, irradiated by 0.5 Mrad, cause a delay of the repair of DNA-single-strand-breaks. Glucose irradiated by 0.5 Mrad in the presence of 10^{-4}M Zn^{2+}-ions inhibits the rejoining of single-strand-breaks completely. Glucose solutions, both with and without Zn^{2+}-ions, irradiated with 2 Mrad, block the recombination of the strand-breaks completely. (auth)

7428 MODEL FOR REPAIR INHIBITION BY CAFFEINE. Lang, H. (Zentralinstitut fuer Genetik und Kulturpflanzenforschung, Gatersleban, Ger.). Stud. Biophys.; 50: 213-221(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

Caffeine is known to potentiate the effects of several chemical or physical agents in the living organism by inhibition of repair processes. Despite its widespread use as repair inhibitor its action on the molecular level is not well known. Taking the results obtained recently on the interaction of caffeine with nucleic acids, especially DNA and its action on the conformation of DNA (preservation of B-type DNA) as a basis for its mode of action a model for repair inhibition by caffeine is suggested. According to this hypothesis the exogenically induced conformational changes of DNA which can act as recognition sites for enzymes will be reverted to the B-type structure by insertion of caffeine molecules and thus those recognition sites disappear and the repair process is inhibited. (auth)

Radiation Effects on Cells

Refer also to abstracts 7425, 7464, and 7529.

7429 AGE-DEPENDENCE OF THE X-RAY-INDUCED DEFICIENCY IN DNA SYNTHESIS IN HeLa S3 CELLS DURING GENERATION 1. Griffiths, T. D.; Tolmach, L. J. (Washington Univ. School of Medicine, St. Louis). Radiat. Res., 63: No. 3, 501-520(Sep 1975).

The radiation-induced deficiency in DNA synthesis in Generation 1 was studied as a function of the age of HeLa S3 cells at the time of exposure to 220 kV x rays in the previous generation (Generation 0). The amount of DNA synthesized is dependent on the stage in the generation cycle at which cells are irradiated. The smallest deficiency (20 to 35 percent after a dose of 500 rad) is observed in cells irradiated in early G1 or early G2, while the greatest deficiency (55 to 70 percent after 500 rad) is found in cells irradiated at mitosis or at the G1/S transition. The high sensitivity of cells at G1/S is also manifested by a steeper dose-response curve. Cells irradiated in late G2, past the point where their progression is temporarily blocked by x rays, synthesize a normal amount of DNA in Generation 1, while cells that are held up in the G2 block exhibit deficient synthesis in the next generation. The extent of the deficiency in early G1 cells can be enhanced by treatment with 1 mM hydroxyurea for several hours immediately following irradiation. The possibility that deficient DNA synthesis is related to cell killing, and the relation between the G2 block and deficient synthesis, are discussed. (auth)

7430 AGE RESPONSE FOR LINE CHO CHINESE HAMSTER CELLS EXPOSED TO X IRRADIATION AND ALPHA PARTICLES FROM PLUTONIUM. Raju, M. R.; Tobey, R. A.; Jett, J. H.; Walters, R. A. (Los Alamos Scientific Lab., NM). Radiat. Res.; 63: No. 3, 422-433(Sep 1975).

The age response of Chinese hamster cells (line CHO) synchronized by mitotic selection and by mitotic selection with hydroxy-

urea resynchronization was studied for x rays and alpha particles from plutonium of 4.4-MeV residual energy. The age response for alpha particles when mitotically synchronized cells are used indicated that cells in S are slightly more sensitive but that the magnitude of variation is quite small. When cells were synchronized first by mitotic selection and then resynchronized by hydroxyurea, the variation of radiosensitivity as a function of cell cycle for x rays was found to be enhanced because of a higher degree of synchrony. In the case of alpha particles, it was found that cells in late S were more sensitive and that there was a clear peak of resistance corresponding to cells in G_2/early G_1. (auth)

7431 CELL KILLING BY GAMMA RAYS AND BETA PARTICLES FROM TRITIATED WATER AND INCORPORATED TRITIATED THYMIDINE. Bedford, J. S.; Mitchell, J. B.; Griggs, H. G.; Bender, M. A. (Vanderbilt Univ. Hospital, Nashville). Radiat. Res.; 63: No. 3, 531-543(Sep 1975).

With the use of two mammalian cell lines (L5178Y and V79), a comparison was made of the efficiency of cell killing by gamma rays and beta particles from tritiated water and incorporated tritiated thymidine. For the latter, cells were incubated with tritiated thymidine for one generation (unifilar labeling) or for four generations (bifilar labeling). To prevent cell division during exposures, irradiations were carried out with cells held in the frozen state or, in one case, at 5°C. There was no significant difference in cell killing efficiency for unifilar or bifilar modes of tritiated thymidine incorporation. In the frozen state an increase in D_0 was observed for all modes of irradiation, but an apparent increase in killing efficiency was observed for irradiations following incorporation of tritiated thymidine relative to that observed for irradiations with gamma rays. For cells irradiated at 5°C, the efficiency of cell killing by beta particles from tritiated water or incorporated tritiated thymidine was not appreciably different, but both were more efficient than gamma irradiation delivered under similar conditions. For killing of V79 cells at 5°C, and at a dose rate of 20 rad/hr, the relative biological effectiveness (RBE) of tritium beta particles relative to cobalt-60 gamma rays was estimated to be approximately 1.7 to 1.9. (auth)

7432 BIOCHEMICAL AND GENETIC STUDIES ON MAMMALIAN CELLS. Puck, T. T. (Univ. of Colorado, Denever). In Vitro; 7: No. 3, 115-119(1971).

A methodology is developed for the investigation of biochemical and genetic phenomena associated with mammalian cell cultures. During the course of the discussion, the mutagenic effects of EMS, X rays, and ultraviolet radiation are mentioned. The modifying effects of caffeine on the survival curves of x- and ultraviolet irradiated mammalian cells is also discussed. (ERB)

7433 DNA REPAIR AND UV-LIGHT SENSITIVITY OF THE LYMPHOCYTES IN DISCOID LUPUS ERYTHEMATOSUS. Horkay, I.; Nagy, E.; Tamasi, P.; Szabo, M.; Csongor, J. (Univ., Debrecen, Hungary). Stud. Biophys.; 50: 1-6(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

Excision repair and cell damage induced by uv-light were studied in peripheral lymphocyte cultures derived from patients with discoid lupus erythematosus. Radioactivity /^{3}H-thymidine-incorporation/ was measured by means of a Packard liquid-scintillation counter, cell damage after uv-irradiation was estimated by vital staining with trypan-blue and by decrease of the cell-count. Repair incorporation of mostly normal rate could be demonstrated in the lymphocyte cultures of all the 22 patients with discoid lupus erythematosus. The cell damaging effect of uv-light was more increased in these cultures than in those of the normal controls. The repair-inhibiting effect of chloroquine administered orally in therapeutic doses to the patients was generally slight and incidental. The possible correlation of the findings is discussed. (auth)

7434 DATA ON HUMAN LYMPHOCYTE DNA WITH SPECIAL ATTENTION TO THE PATHOGENESIS OF SYSTEMIC LUPUS ERYTHEMATOSUS. Balo-Banga, J. M. (Semmelweis Univ, Budapest). Stud. Biophys.; 50: 7-19(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

In addition to in vitro lymphocyte stimulation by phytomitogens, specific antigens or allogeneic cells there are conditions under which a large proportion of circulating peripheral blood lymphocytes is "turned on" or is close to be "turned on" to synthesize deoxyribonucleic acid /DNA/. At least 30% of this newly synthesized DNA is excreted into the media. This situation can be modellized by a heterogeneous lymphoid population stimulated probably in vivo obtained from children's tonsils. A specific portion of newly synthesized DNA can be isolated from the plasma-membranes of tonsillar lymphocytes. It contains single-stranded chromosomal DNA of about 16 S sedimentation from which light-satellite and homogeneous sequences are specifically lacking. 30 krad x-rays block the synthesis and/or excretion of this material into the media. The observed phenomena together with some clinical observations might be helpful in understanding the aetiopathogenesis of systemic lupus erythematosus. (auth)

7435 CORRELATION BETWEEN THE OCCURRENCE OF MYCOPLASMA AND DNA REPAIR INHIBITION IN SPLEEN CELLS OF RATS DURING EXPERIMENTAL MYCOPLASMA ARTHRITIS. Laber, G. (Sandoz, Forschungsinstitut, Liesing, Austria); Schuetze, E.; Teherani, D. K.; Tuschl, H.; Altmann, H. Stud. Biophys.; 50: 21-26(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

Mycoplasmas, strain M. arthritidis (ISR), were labelled in vitro by ^{3}H-thymidine and inoculated intraperitoneally to Sprague Dawley rats. Certain times after infection the animals were sacrificed and in accordance with the radioactivity measurements mycoplasmas were determined by microbiological methods. The investigations of DNA repair in spleen cells were carried out by autoradiography in the presence of hydroxyurea. Good correlation between the occurrence of mycoplasmas in the spleen and the observed inhibition of DNA repair was found. (auth)

7436 DNA-REPAIR AND DNA-ANTIBODIES DURING EXPERIMENTAL MYCOPLASMA ARTHRITIS. Klein, G.; Wottawa, A. (Medizinische Univ., Graz). Stud. Biophys.; 50: 27-31(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

To clarify the pathogenesis of a mycoplasma induced arthritis in rats investigations were carried out on the influence of mycoplasma infection on DNA repair and the occurrence of DNA antibodies. During acute and subacute stage of the experimentally induced arthritis an inhibition of DNA repair could be observed. Besides the results indicated a correlation between reduced or inhibited DNA repair and the appearance of DNA antibodies could be found. (auth)

7437 DNA REPAIR AFTER NEUTRON AND GAMMA IRRADIATION. Tuschl, H.; Klein, W.; Kocsis, F.; Kovac, R.; Altmann, H. (Forschungszentrum, Seibersdorf, Austria). Stud. Biophys.; 50: 55-64(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

Recently there has been increased interest in the use of fast neutrons for therapy of cancer. Because of the importance of repair processes in radiation therapy we investigated DNA repair after neutron and ^{60}Co gamma irradiation. Unscheduled DNA synthesis was measured in spleen cells and peripheral lymphocytes by autoradiography, and the rejoining of DNA strand breaks by alkaline and neutral sucrose gradient centrifugation. Up to doses of 30 krad neutrons, unscheduled DNA synthesis could be demonstrated while strand rejoining occurred up to doses of 15 krad. Besides investigating DNA repair, semiconservative DNA synthesis was measured after various irradiation doses, the amount of suppression exhibiting good correlation with radiation dose. (auth)

7438 UNSCHEDULED DNA SYNTHESIS IN HUMAN LYMPHOCYTES γ-IRRADIATED IN VITRO AND ITS CHEMICAL INHIBITION. Voiculetz, N.; Sbenghe, M.; Sandulescu, T. (Oncological Inst., Bucharest). Stud. Biophys.; 50: 97-105(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

The inhibitory effect of some chemical compounds on unscheduled DNA synthesis in γ-irradiated human lymphocytes was measured. Quinacrine ($4 \cdot 10^{-5}$M), iodoacetamide (10^{-3}M) and sodium iodoacetate (10^{-2}M) inhibit the incorporation of ^{3}H-thimidine in unscheduled DNA synthesis, while KI (10^{-2}M), KIO_3(10^{-3}M), cycloheximide ($2 \cdot 10^{-5}$M), caffeine (10^{-2}M) and phenylalanine-mustard (10^{-5}M) do not. In addition, phenylalanine-mustard increased the incorporation of ^{3}H-thymidine, which appeared to be additive to that following the radiation effect and it seemed to be concentration dependent. It was demonstrated that unscheduled DNA synthesis may be used to screen potential radiosensitizing compounds which act on the repair of DNA single-strand breaks induced by ionizing radiations. (auth)

7439 REJOINING OF DOUBLE-STRAND BREAKS IN THE DNA OF IRRADIATED MAMMALIAN CELLS. Hartwig, M.; Handschack, W. (Central Inst. of Molecular Biology, Berlin). Stud. Biophys.; 50: 203-211(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

Using the neutral sucrose gradient technique the sedimentation of DNA from x-irradiated Chinese hamster cells (strains

V79 and FAF 28) was studied in the S- and G2-phase of the cell cycle. Overcoming sedimentation anomalies by a post-irradiation of the cells and low speed centrifugation, it was found that these cells are able to rejoin double-strand breaks at 37°C. (auth)

7440 CHANGES OF ELECTRIC CHARGES IN THE SURFACE MEMBRANE OF CHINESE HAMSTER CELLS INDUCED BY ULTRAVIOLET IRRADIATION. Gram, I.; Pitra, C.; Abel, H. (Central Inst. of Molecular Biology, Berlin). Stud. Biophys.; 50: 223-230(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

UV irradiation (259 nm) reduced the net charge and electrophoretic mobility in cultured Chinese hamster cells, depending on the doses applied and the incubation time after exposure. After uv irradiation with lower doses a lag period in the reduction of the cell mobility and a recovery of the decreased mean electrophoretic mobility was observed. Treatment of cells with actinomycin D or cycloheximide partly prevented the uv-induced reduction in electrophoretic mobility. If the decrease of electrophoretic mobility in cells by uv light requires RNA and/or protein synthesis, we can assume that the radiation did not act directly on components of the surface membrane, but through damages at the genetical or epigenetical level. (auth)

7441 ASSEMBLY OF NEWLY REPLICATED DNA INTO CHROMATIN. Weintraub, H. (Lab. of Molecular Biology, Cambridge, Eng.). Cold Spring Harbor Symp. Quant. Biol.; 38: 247-256(1973).

How does the cell map the "one-ness" of the parental chromosome into the "two-ness" of its daughters. For the DNA component of the chromosome, the solution, in its most general form, was provided by the realization of the structure of DNA (Watson and Crick, 1953); for the remaining chromosomal elements, very little is known. The experiments to be presented here deal with this question and indicate that the newly synthesized daughter strands become associated with newly synthesized protein within 1 min of replication. Together with recycled protein from the parental chromosome, these two contributions can account for most of the non-DNA mass entering the two daughter chromosomes. During inhibition of protein synthesis, evidence is presented that only one of two daughter DNA strands receives recycled proteins from the parental chromosome. This finding raises the possibility that during normal chromosome replication, the distribution of parental chromosomal proteins to the daughter strands is non-dispersive for long stretches of DNA in individual replicons. A preliminary analysis of a new technique for the in vivo cross-linking of proteins to particular regions of the DNA will be described. (auth)

Radiation Effects on Microorganisms

Refer also to abstracts 7422–7424, and 7452.

7442 INACTIVATION OF TISSUE CULTURE ANTIRABIES VACCINE WITH UV RAYS. Morogova, V. M.; Selimov, M. A.; Aksenova, T. A.; Pospeeva, N. A.; Gul'dina, S. S.; Klyueva, E. V. (Scientific-Research Inst. of Vaccine and Serum, Moscow). Vop. Virusol.; 18: 422-425(1973). (In Russian).

An optimal regimen for inactivation of tissue culture antirabies vaccine of the USSR AMS Institute of Poliomyelitis and Virus Encephalitides has been developed in an uv-ray irradiator. The tissue culture antirabies vaccine (12 batches) inactivated by uv-rays has been shown to have almost the same immunogenic potency as the original virus-containing culture fluid, whereas inactivation of this vaccine with 0.5% phenol at 22°C for 48 hours is accompanied by a significant loss of its immunogenic properties. The uv-rays inactivated tissue culture antirabies vaccine is more immunogenic than the commercial lyophilized phenol antirabies vaccine from sheep brains. (auth)

7443 TIME SCALE OF RADIATION-INDUCED OXYGEN DEPLETION AND DECAY KINETICS OF OXYGEN-DEPENDENT DAMAGE IN CELLS IRRADIATED AT ULTRAHIGH DOSE RATES. Ling, C. C. (Sloan-Kettering Cancer Center, New York). Radiat. Res.; 63: No. 3, 455-467(Sep 1975).

A mathematical model is proposed to explain the experimental observation of breaking survival curves obtained in ultrahigh dose rate studies. The model examines the kinetics of radiation-induced oxygen depletion in cells and of the decay and reactions of oxygen-dependent damage postulated to be involved in the oxygen effect for cells. A reaction scheme is assumed for radiochemical oxygen depletion where a set of radiation-induced species reacts with and binds dissolved oxygen molecules. The proposed theory of Howard–Flanders and Moore on oxygen-dependent injury is also adopted to provide a description of the reaction and decay characteristics of the oxygen-dependent damage. A computerized examination of the time-dependent interaction of the above described processes indicates that calculated breaking survival curves are in good agreement with those observed experimentally. (auth)

7444 X-RAY INDUCED INACTIVATION OF THE CAPACITY FOR PHOTOSYNTHETIC OXYGEN EVOLUTION AND NITRATE REDUCTION IN BLUE-GREEN ALGAE. Stevens, S. E.; Jr.; Simic, M. G.; Rao, V. S. K. (Univ. of Texas, Austin). Radiat. Res.; 63: No. 3, 395-402(Sep 1975).

The level of inactivation of oxygen evolving photosynthesis in the green alga, Chlorella pyrenoidosa was 12 percent in N_2 at a dose of 100 krad of x irradiation. Under similar conditions, as well as under O_2, there resulted a 20 percent inactivation of the same function in the blue-green algae, Agmenellum quadruplicatum, strains PR-6 and AQ-6. Nitrate reduction capacity in the mutant AQ-6 was inactivated to 40 percent in N_2 and to 7 percent in O_2. Catalase and formate provided some protection from irradiation in O_2, suggesting some inactivation by H_2O_2. Most of the damage to the nitrate reduction system resulted from the direct action of x irradiation on a constitutive subunit of the nitrate reductase complex. Moreover, the slight inactivation of the O_2 evolving system, a function which is associated with photosystem II, cannot account for the inactivation of nitrate reduction. (auth)

7445 SYNERGISTIC EFFECT OF SIMULTANEOUS EXPOSURE TO ^{60}Co GAMMA RAYS AND ^{210}Po ALPHA RAYS IN DIPLOID YEAST. Murthy, M. S. S.; Madhvanath, U.; Subrahmanyam, P.; Rao, B. S.; Reddy, N. M. S. (Bhabha Atomic Research Centre, Bombay). Radiat. Res.; 63: No. 1, 185-190(Jul 1975).

The effect of the simultaneous exposure of diploid yeast to both ^{60}Co gamma radiation and ^{210}Po alpha radiation is studied, with reversion to arginine independence as the end point. It is found that gamma rays (low LET) are more effective in the presence of ^{210}Po alpha rays (high LET) than when administered alone. This suggests a synergistic interaction of the effects of the two types of radiations. For a combination of 25 percent alpha dose and 75 percent gamma dose the synergism factor is found to be about 1.34 +- 0.09. (auth)

7446 RADIATION SENSITIVITY OF BACILLUS MEGATERIUM SPORES IN THE PRESENCE OF Co(III) COMPLEXES. Richmond, R. C.; Simic, M.; Powers, E. L. (Univ. of Texas, Austin). Radiat. Res.; 63: No. 1, 140-148(Jul 1975).

Investigation of radiation sensitization by cobalt hexammine chloride of B. megaterium spores either in aqueous suspension or equilibrated at 22 torr water vapor pressure reveals a unique duplication of sensitizing action in both the presence and absence of oxygen. Ethanol reverses this cobalt-complex sensitizing in anoxic, but not oxic, spore suspensions, whereas t-butanol has no protective effect. A series of Co(III) complexes is tested for anoxic sensitization to compare with hexammine complex. The sensitizing ability of these compounds is much reduced or absent when bidentate or multidentate organic ligands replace the ammine coordinates to cobalt. (auth)

7447 SURVIVAL OF SYNCHRONIZED DIPLOID YEAST AFTER ULTRAVIOLET IRRADIATION. Nunes, E.; Lorido, L.; Gelos, U. (Universidad de la Republica, Montevideo). Radiat. Res.; 63: No. 3, 474-482(Sep 1975).

Synchronized populations of diploid yeast were exposed to uv light and their survival thereafter upon immediate plating (IP) and after liquid holding (LH) treatment in the presence and absence of caffeine was examined. These cells were found to be most resistant to uv light during early budding (G_2 period). The effect of LH is positive throughout the cell cycle and is dependent on the radiosensitivity of the cells upon IP. Caffeine-sensitive and caffeine-insensitive components of dark repair were demonstrated. The uv light responses of logarithmic growing and synchronized populations were compared with x-ray responses of the same strain analyzed under the same conditions in a previous work. The pattern of variation in sensitivity throughout the cell cycle and the ability to recover are qualitatively similar. The caffeine-insensitive component of repair has a similar efficiency in uv and x-irradiated G_1 cells, increasing in uv-irradiated cells after the beginning of the DNA synthetic period and during the G_2 period. The findings observed under IP conditions are consistent with a model already proposed which requires the repair efficiency to oscillate during the cell cycle. The results suggest that repair pathways for lethal uv damage may share some common steps with those for x-ray damage. (auth)

7448 FOWL PLAGUE VIRUS REPLICATION IN MAMMALIAN CELL-AVIAN ERYTHROCYTE HETEROKARYONS: STUDIES CONCERNING THE ACTINOMYCIN D AND ULTRA-VIOLET LIG SEN-

SITIVE PHASE IN INFLUENZA VIRUS REPLICATION. Kelly, D. C.; Dimmock, N. J. (Univ. of Warwick, Eng.). Virology; 61: No. 1, 210-222(Sep 1974).

The replication of fowl plague virus in BHK and L cells specifically blocked prior to infection with inhibitors of influenza virus replication (actinomycin D and ultraviolet light irradiation) has been studied by the introduction of a metabolically dormant avian erythrocyte nucleus. This permits the synthesis of just the influenza virus nucleoprotein in actinomycin D (but not ultraviolet light) blocked cells. The NP antigen is first detected in the avian erythrocyte nucleus and subsequently in the heterokaryon cytoplasm. (auth)

7449 BACTERIOPHAGE M13 GENE 2 PROTEIN: INCREASING ITS YIELD IN INFECTED CELLS, AND IDENTIFICATION AND LOCALIZATION. Lin, N. S. C.; Pratt, D. (Univ. of California, Davis). Virology; 61: No. 2, 334-342(Oct 1974).

M13 gene 2 protein, implicated in the introduction of single-strand nicks into double-stranded closed circular (RFI) DNA molecules, was previously found in only very small quantities in infected cells. We now find that the gene 2 protein can be readily identified and its yield can be increased manyfold if infections are carried out at high temperature with either a gene 2 temperature-sensitive mutant or with wild type M13. Mechanisms are suggested by which the increased yield could result from subnormal function of the protein in these infections. Under conditions of high yield, the gene 2 protein is found largely in a rapidly sedimenting particulate fraction of unknown nature, where it constitutes as much as 36 percent of the leucine-labeled protein. The gene 2 protein can be readily solubilized from this particulate fraction with the ionic detergent sodium dodecyl sulfate (SDS) but no satisfactory solubilization method was found which keeps the protein in its native state. Attempts to demonstrate in vitro activity of the gene 2 protein, that is, nicking of M13 RFI DNA, were not successful. On the basis of SDS-polyacrylamide gel electrophoresis, we estimate that the gene 2 polypeptide has a molecular weight of approximately 40,000. In the course of the experiments on gene 2 protein, it was observed that the gene 3, as well as the gene 8, virion protein molecules were found predominantly in the cell inner membrane, supporting the idea that virion assembly is carried out there. The gene 4, nonvirion, protein also proved to be in the inner membrane, as would be expected if this protein plays a role in virion assembly. (auth)

7450 CHEMICAL CHANGES ASSOCIATED WITH FLAVOR IN IRRADIATED MEAT. Merritt, C. Jr.; Angelini, P.; Wierbicki, E.; Schults, G. W. (Army Natick Labs., MA). Environ. Res.; 9: No. 3, 1037-1041(Jun 1975).

Chemical changes in meat that has been treated with ionizing radiations have been well documented. The recent development of new improved analytical methods employing combined gas chromatography and mass spectrometry systems with digital outputs permits computer processing of both qualitative and quantitative data. Precise determination of the variation in the amounts of components with various treatment conditions such as dose and temperature has now been made and correlated with sensory observations. The irradiation flavor increased and overall acceptance decreased with an increase in dose and/or irradiation temperature. Correspondingly, analyses of volatile compounds show increases of amount with increases in dose or irradiation temperature. When the proper conditions of dose and temperature are employed, however, wholly acceptable products that are both safe and savory can be produced. (auth)

7451 EFFECTS OF IONIZING RADIATION ON MICROORGANISMS AND RADIOSTERILIZATION OF MEDICAL PRODUCTS. Tumanyan, M. A. pp 100-107 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The problem of radiosterilization consists of the inter-related aspects of the effects of ionizing radiation on microorganisms, the possibility of sterilizing different objects, and radiation sources. A bibliography review is given of studies made in each of these three areas. (32 references) (JSR)

7452 INCREASE OF THE RADIORESISTANCE OF MICROORGANISMS IN CONNECTION WITH THE USE OF IONIZING RADIATION FOR RADIOSTERILIZATION. Pershina, Z. G.; Tumanyan, M. A.; Samoilenko, I. I.; Pavlova, I. B. pp 107-109 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Data are reported on obtaining bacteria with increased radioresistance as a result of multiple γ radiation. Salmonella typhosa, dysenteric bacteria, E. coli, and staphylococcus were exposed to ^{60}Co at a dose rate of 9.5 krad/min. The culture conditions were standard. The results showed that irradiation significantly changes the properties of the microorganisms. It leads to saprophytization of the bacteria. There is a loss of virulence, decrease of the fermentation activity, change of the cytology of the cells, and a significant increase of the radioresistance. (JSR)

7453 SELECTION OF THE TEST MICROBE FOR CONTROL OF THE EFFICIENCY OF STERILIZATION BY IONIZING RADIATION. Ramkova, N. V.; Dishkant, I. P. pp 109-112 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

From 28 soil samples and 10 sections of catgut irradiated with different doses of γ radiation, 78 strains of different microorganisms were separated and their resistance to different agents was tested. Of the 78 strains separated from irradiated samples and 52 museum strains of spore-forming bacteria separated from the water of nuclear reactors, a test culture was selected representing the strain B. subtilis and having a stability to the effects of γ radiation at a dose of 1.75 Mrad. This culture was used as a test for the control of the efficiency of γ sterilization of different objects. Soil samples should not be used as efficiency controls because of the inhomogeneous stability of their microorganisms to ionizing radiation. (tr-auth)

7454 USE OF IONIZING RADIATION FOR STERILIZATION OF PLASTIC BAGS WITH BLOOD PRESERVING SOLUTIONS. Manueva, G. N.; Bolotnikova, F. I. pp 112-116 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Preliminary experiments on the stability of blood preserving solutions under the effects of electron and γ radiation showed that electrons led to a yellow coloration of the solutions, whereas γ radiation had no effect. The effect of the length of storage, γ dose, and quality of the plastic on distilled water in the plastic bags was then studied. The results are tabulated for storage lengths of 10 days and one year and show that γ radiation at a dose of 1 Mrad can be used for sterilization if the quality of the plastic bags is improved and with rigid observation of asepsis rules. (JSR)

7455 USE OF γ RADIATION FOR THE STERILIZATION OF CATGUT. Vashkov, V. I.; Dishkant, I. P. pp 117-119 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Studies made on the radiosterilization of catgut showed that the most prevalent microorganisms and the most radioresistant are the aerobic ones. However radiation doses high enough to destroy these microorganisms did not impair the quality of the catgut. The process has been approved for industrial use. (JSR)

7456 RADIOSTERILIZATION OF PETRI DISHES, HYPODERMIC SYRINGES, AND OTHER ARTICLES OF MEDICAL USE MADE OF PLASTICS. Pershina, Z. G.; Tumanyan, M. A. pp 119-121 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

As plastic materials cannot be sterilized by high temperatures, studies were made to determine in plastic medical supplies could be sterilized by γ radiation. The results showed that these articles could be sterilized by doses from 1 to 5 Mrad without impairment of their quality. The dose selected for sterilization would depend on the initial contamination. (JSR)

7457 STERILIZATION OF DRESSINGS AND INSTRUMENTS BY γ RADIATION. Shevchenko, I. T.; Surkov, G. G.; Boiko, L. D.; Dyul'dina, A. S.; Zver'kov, L. S. pp 121-122 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The sterilizing effects of γ radiation for surgical dressings and instruments were studied. The radio-induced changes in the properties of antibiotics used to impregnate dressings were also

evaluated. The results showed that a dose of 3 MR guaranteed sterilization and did not affect the specific properties of antibiotics. (JSR)

7458 EFFECT OF RADIOSTERILIZATION ON THE PHYSICO-CHEMICAL PROPERTIES OF BLOOD-STOPPING GAUZE AND ON THE BIOLOGICAL ACTIVITY OF ALBUMIN PREPARATIONS. Martynova, V. A.; Rudnitskaya, M. Z.; Golosova, T. V.; Dol'-berg, E. B.; Rashbam, Ya. Yu. pp 123-125 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The effect of γ radiation at a dose output of 760 R/sec and of 5-Mev electrons at a dose of 300 krad/sec on the dried hemostatic properties of blood plasma (thrombin, fibrinogen, and fibrin) and on a synthetic blood-stopping plasma and the liquid heteroalbumin preparation BK-8 was studied. The samples were irradiated to doses of 500 krad and 1, 1.5, 2.5, and 3 Mrad. The results showed that doses of 2 Mrad alter the biological value of fibrinogen and thrombin. However fibrin and BK-8 can withstand doses of 2.5 Mrad and the gauze, doses of 5 Mrad. (JSR)

7459 RADIATION STERILIZATION OF DRESSINGS AND PACKINGS. Bazhbeuk-Melikova, T. V.; Kotlyarskaya, E. M.; Orekhova, V. D.; Ramkova, N. V.; Pismannik, K. D.; Khrushchev, V. G. pp 125-127 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Hygroscopic cotton and bandages were exposed to ^{60}Co γ radiation at dose rates from 10 to 300 rad/sec. An evaluation of the sterility of these materials showed that a dose of 2.23 to 2.5 Mrad was necessary to guarantee the destruction of all microorganisms. The installation developed for the sterilization is briefly described. (JSR)

7460 STERILIZATION OF ANTIBIOTICS. Pochapinskii, V. I.; Storozhev, I. A.; Eidel'shtein, S. I.; Rubtsova, L. K.; Kosolapova, I. V.; Pchelina, O. I. pp 127-132 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The acute toxicity of a series of antibiotics, irradiated with γ radiation at doses of 2.5 Mrad and up to 8.0 Mrad in some cases, was studied in white mice. The results showed that the toxicity of the K, Na, and novocaine salts of benzylpenicillin are not changed by the irradiation; the toxicity of streptomycin and the tetracyclines is not increased. Their pharmacological properties are unaffected. A second series of studies showed that the acute toxicity of oxytetracycline and streptomycin was not affected by irradiation doses up to 8 Mrad, but was a function of the amount injected per body weight. (JSR)

7461 USING OF IONIZING RADIATION FOR THE PREPARATION AND STERILIZATION OF DIFFERENT BACTERIAL PRODUCTS. Tumanyan, M. A.; Duplishcheva, A. P.; Kaulen, D. R.; Chakhava, O. V.; Ivanov, K. K.; Shibaeva, I. V.; Izvekova, A. V.; Khrushchev, V. G. pp 132-138 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The use of γ radiation for the sterilization of culture media, sterilization of antidiphtheria sera, diphtheria anatoxin, and some antimicrobe diagnostic sera, and for the production of radiovaccines and radioantigens were studied. The toxicity and immunogenic properties of the radiovaccines and antigens were tested using rats, mice, and rabbits. The tabulated results show that sterilizing doses do not affect the properties of the culture media and γ radiation can be used for the preparation of the radiovaccines and antigens. However, radiation adversely affects the sera tested. (JSR)

7462 COMPARATIVE EVALUATION OF THE USE OF GAMMA INSTALLATIONS AND ELECTRON ACCELERATORS FOR THE INDUSTRIAL STERILIZATION OF MEDICAL PREPARATIONS. Smirnov, V. I.; Shan'gina, A. N.; Ermol'eva, V. V.; Zorin, V. A.; Orlenko, P. A.; Titkov, Yu. S.; Poluektov, L. P.; Ivanter, E. L.; Breger, A. Kh.; Kozlov, Yu. D. pp 345-349 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A comparative evaluation is made of sterilization using ^{60}Co installations, the liquid metal radiation loop of a nuclear power plant, and electron accelerators. The capital costs and operating costs for each type of installation are evaluated. (JSR)

7463 PROPERTIES OF ATP DEPENDENT DEOXYRIBONUCLEASE AND ITS POSSIBLE ROLE IN DEOXYRIBONUCLEIC ACID DEGRADATION OF BACILLUS CEREUS IRRADIATED BY ULTRAVIOLET LIGHT. Banfalvi, G.; Antoni, F.; Czuzi, S. (Semmelweis Univ., Budapest). Stud. Biophys.; 50: 89-96(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

DNA degradation and an increased level of DNases in the crude extract of irradiated B. cereus culture has been observed. As a result of a more detailed study of ATP dependent DNase, the optimum pH (pH9) and ATP dependency, furthermore optimum ATP concentration (2 mM) were established. The enzyme degrades the native DNA at a rate about 4 to 5 times higher than the thermally denaturated DNA. Samples of the DNA irradiated by increasing doses of uv light were hydrolyzed at decreasing rates. The native and uv irradiated DNA were degraded at nearly equal rates, on this basis it is supposed that the enzyme preferentially forms a complex with the native rather than with the irradiated DNA. (auth)

7464 STUDIES ON CHLOROQUINE AS A DNA REPAIR INHIBITOR. Lopez Zumel, M. C.; Astudillo, M. D.; Alvarez, M. V. (CSIC, Madrid). Stud. Biophys.; 50: 107-115(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

Cellular systems have their own repair mechanisms to protect themselves from the ionizing radiation effects. DNA is the most important target in the radiation attack and the inhibition of its synthesis is one of the results. In the cellular repair mechanisms one non-scheduled synthesis of DNA is involved. The inhibitors of the DNA repair synthesis have been included in a recent classification of radiosensitizers and, equally, these compounds are very important in the radiotherapy of tumors for their action on the control of the DNA synthesis. Chloroquine, an antimalarial, is one of the products which, potentially, affect the DNA synthesis and different authors are working on the possible mechanisms of its action. This paper shows our results from kinetical experiments on the DNA repair replication of spleen cells and from survival curves on yeast irradiated cells when they are treated with chloroquine as a repair inhibitor. In order to explain these results, several experiments on molecules involved in the DNA synthesis are, also, carried out. Their degradation is measured spectroscopically and by the release of phosphate groups induced by radiation effect. (auth)

7465 MUTAGENICITY OF IRRADIATED FOOD IN THE HOST MEDIATED ASSAY SYSTEM. Johnston-Arthur, T.; Brena-Valle, M.; Turanitz, K.; Hruby, R.; Stehlik, G. (Forschungszentrum, Seibersdorf, Austria). Stud. Biophys.; 50: 137-141(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

Groups of Swiss albino mice (SPF) fed with normal and gamma-irradiated food at doses of 0.75, 1.5, and 3.0 Mrad, were injected intraperitoneally with Salmonella typhimurium TA 1530 for the host mediated assay test of mutagenesis. The mutation frequency was calculated in terms of the number of mutant colonies per unit number of surviving cells. The results indicate that there is a significant increase in mutation frequency induced by the 3 Mrad sterilized food. No difference was observed in the 0.75 Mrad dose when compared with the control. (auth)

7466 INFLUENCE OF AFLATOXIN B_1 ON DNA REPAIR IN E. COLI. Stehlik, G.; Delac, M.; Kohlwein, E. (Forschungszentrum, Seibersdorf, Austria). Stud. Biophys.; 50: 151-159 (1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

The thymidine requiring mutant E. coli B/r T^- was incubated for 160 minutes with aflatoxin B_1 in the concentration range between 0.001 and 1.0/ug/ml. After gamma irradiation (30 krad ^{60}Co) DNA repair was observed during 20-60 minutes at 37°C. DNA was separated by means of a modified kind of gradient ultracentrifugation (the alkaline sucrose gradient contained acrylamide). By this modification between results could be obtained even with little differences in the sedimentation profile. After several repair times DNA of cells treated with 0.1-1.0/ug/ml aflatoxin showed no shift in its sedimentation profile as compared with the irradiated sample. This substance caused an increase in radioresistance of E. coli B/r T^- which may be due to a protection

effect on DNA. This assumption is also supported by irradiation survival curves. (auth)

7467 PENICILLIUM STOLONIFERUM VIRUS. Altered Replication in Ultraviolet-derived Mutants. Still, P. E.; Detroy, R. W.; Hesseltine, C. W. (Dept. of Agriculture, Peoria, IL). J. Gen. Virol.; 27: No. 3, 275-281(Jun 1975).

Phenotypic mutants of the wild type of Penicillium stoloniferum NRRL 5267 were obtained from conidia exposed to ultraviolet light for 60 min (10% survival). Virus content of the wild type and of nine phenotypic mutants was determined by polyacrylamide gel electrophoresis. Four mutants had no detectable Penicillium stoloniferum virus F(PsV-F), whereas the other five had levels of PsV-F in the mycelium similar to the wild-type strain. All nine mutants and the wild type had comparable levels of Penicillium stoloniferum virus S(PsV-S). Maximum virus levels occurred after 9 days of submerged culture in a 2% yeast extract-15% sucrose medium. Virus replication in the fungal host continued after protein, RNA and DNA synthesis levelled off. Virus levels ranged from 85 to 150 E_{260} units (extinction units at 260 nm in 1 cm cell) per 4.7 to 5.3g dry weight of mycelium for the mutant strains compared to 106 E_{260} units per 4.2g dry weight of the wild-type strain. (auth)

7468 GAMMA RADIATION AS AN EFFECTIVE DISINFECTANT. Murphy, K. L. (McMaster Univ., Hamilton, Ont.). Water Pollut. Control; 112: No. 4, 24; 26; 28(Apr 1974).

Gamma radiation from ^{60}Co can be an effective disinfectant in waste water treatment, by degrading pollutants without inducing radioactivity or adding to the contaminants. This process is not affected by the limitations of chemical disinfectants. Geodel Systems, Georgetown, Ontario, tested the γ process in a pilot plant with a 39,900-Ci source of ^{60}Co in a 70-ft^3 reactor. Four secondary effluent samples were given doses of 1×10^4 to 1.5×10^5 rads. With a 0% to 99.9% inactivation range of coliform indicator organisms, a semilogarithmic relationship existed between surviving ratio and radiation dosage. The reactor design and performance are described. The γ process was as effective as conventional Cl methods, and the resulting effluent was nontoxic. (Pollut. Abstr.)

7469 FATE OF KILTHANE RESIDUES ON APPLE POMACE EXPOSED TO DRYING IN THE DARK, SUNLIGHT, AND ULTRAVIOLET LIGHT IRRADIATION. Archer, T. E.; Toscano, R. A. (Univ. of California, Davis). Bull. Environ. Contam. Toxicol.; 7: No. 6, 353-357(Jun 1972).

The present investigations were undertaken to determine the fate of Kelthane residues intentionally applied to apples under controlled laboratory conditions and the reduction of these residues in the pomace by exposure to drying in the dark, in sunlight, and ultraviolet light irradiation. (auth)

Radiation Effects on Plants

Refer also to abstract 7552.

7470 INDUCTION, DEVELOPMENT, AND INHIBITION OF RADIATION-INDUCED MACROBODIES. Adam, W. J.; Grunewald, R. (Univ. of Wisconsin, Milwaukee). Radiat. Res.; 63: No. 3, 434-442(Sep 1975).

Coleus shoots were exposed to 100,000 R of gamma radiation and the fine structure of the apical meristems was examined. Meristems were fixed at various postirradiation times. An ultrastructural body was found associated with irradiated tissue, bound by a single membrane, containing dense osmiophilic bodies, and usually associated with radiation-induced vacuoles. The development of these new bodies, and the effects of both dose rate and light during the postirradiation period on their development were examined. Reduction of the dose rate by a factor of two inhibited the formation of these macrobodies through the 24 hour postirradiation period. Meristems kept in the dark during the 24 hour postirradiation period had macrobodies similar in form to the macrobodies from the meristems of the 16 hour postirradiation period which were exposed to light. Superlethal doses were used to achieve these results. Similarities between our results and those achieved with lower lethal doses are discussed. (auth)

7471 IONOL MODIFICATION OF NATURAL AND INDUCED CHROMOSOME ABERRATIONS IN CREPIS CAPILLARIS L. (WALLB.). Alekperov, U. K.; Abutalybov, M. G.; Bagirova, A. D. (Botanical Inst. Baku). Dokl. Biol. Sci.; 220: No. 1-6, 31-32(1975).

Translated from Dokl. Adkad. Nauk SSSR; 220: No. 4, 953-954(Feb 1975).

Ionol, a phenol derivative, is an anti-mutagen with a wide spectrum of biological activity. In view of the fact that there is little information on the effects of antimutagens on the genetic structures which are damaged by chemical mutagenesis, an investigation was conducted on the effect of ionol on the yield of natural aberrations and of aberrations caused by treatment with radiation or chemical mutagens. The experimental material was air-dry seeds of Crepis capillaris, the mutagens used were γ rays and ethylenimine. It was found that ionol reduced the level of natural aberrations by more than 50% when seeds were germinated in an ionol solution. Germination of seeds in an ionol solution also decreased the number of radioinduced aberrations by 70% and ethylenimine-induced aberrations in old seeds by 100% (below the level of the control). In seeds with a relatively low frequency of natural chromosome aberrations, ionol reduced the number of ethylenimine-induced aberrations by 82%. (ERB)

Radiation Effects on Animals

Man

Refer also to abstracts 7577, 7599, and 7670.

7472 (AED-CONF-75-244-005) RISK OF RADIATION HAZARDS IN THE THERAPEUTIC APPLICATION OF RADIOACTIVE MATERIALS. Patient–Environment–Personnel. Herzberg, B.; Kaul, A. (Freie Univ. Berlin (F. R. Germany). Klinikum Steglitz). 1975. 12p. (In German). INIS.

From 16th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte; Kiel, F. R. Germany (20 Jun 1975).

1 fig.; 3 tabs.; 13 refs. With abstract.

The following conclusions have been reached: (1). Iodine-131 therapy increases the individual risk of a radiation-induced carcinoma of the thyroid by 2 or 3 orders of magnitude and iridium-192 therapy by 1 order of magnitude; (2) Phosphorus-32 therapy does not heighten the risk of leucemia; (3) These therapies will not increase the risk of genetic lesions; (4) The mean annual radiation exposure of 0.17 mrem per person does not suggest an increase of cancer incidence in the population as a whole, nor does it endanger the group of persons who are professionally exposed to radiation as long as the actual values fall short of the legal dose limits as has been the case so far. (GE)

7473 (AED-CONF-75-244-007) RADIATION EXPOSURE AND BIOLOGICAL PROBLEMS IN SPACE FLIGHTS. Meissner, J. (Forschungsinstitut Borstel (F. R. Germany). Inst. fuer Experimentelle Biologie und Medizin). 1975). 12p. (In German). INIS.

From 16th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte; Kiel, F. R. Germany (20 Jun 1975).

8 figs.; 3 tabs.; 15 refs.

The problems of dosimetry of cosmic rays in space flights are dealt with. Because of the different amounts of radiation involved, the galactic primary radiation is treated separately from the radiation in flares and in the radiation belt which superpose it in time or region. The estimated dose equivalent of the galactic primary radiation is 77 mrem/24 h. Flare bursts on the other hand, may produce a dose equivalent of 100-1,000 rem. In the radiation belt, radiation doses up to a maximum of 100 rem per day have to be expected. The problem of dosimetry of high-energetic corpuscular radiation with extremely high LET is treated in detail. For an assessment of possible radiation hazards, microdosimetric methods will have to be applied. Most susceptible to radiation lesions caused by high-energetic ions are cerebral and spinal cells as well as ganglion cells of the retina. (GE)

7474 (BNL-50424) TWENTY-YEAR REVIEW OF MEDICAL FINDINGS IN A MARSHALLESE POPULATION ACCIDENTALLY EXPOSED TO RADIOACTIVE FALLOUT. Conard, R. A. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. Contract AT(30-1)-16. 154p. Dep. NTIS $6.25.

A summary is presented of results of medical examinations of inhabitants of the Marshall Islands during the 20-year period following the exposure of Rongelap people to radioactive fallout in 1954. The initial effect observed was beta burns of the skin of some individuals. Few significant findings were observed during the subsequent 9-year period, although an increase in miscarriages and stillbirths among the exposed women was noted. In 1963 some thyroid abnormalities and growth retardation of some children were noted. (177 references). (CH)

7475 (DEU-75-16, pp 24) MEAN GENETIC RADIATION EXPOSURE OF THE HUMAN POPULATION IN THE GERMAN FEDERAL REPUBLIC 1972. 1974. (In German).

1 ref.

In peaceful use of nuclear energy. Statements of scientists: a documentation. (Ministerium fuer Wirtschaft, Mittlestand und Verkehr Baden-Wuerttemberg, Stuttgart (F. R. Germany)).

Tables of the average genetic radiation exposure of the population through natural and artificial radiation sources in the FRG for the year 1972 are given. (GE)

7476 (ORNL-TM-5134) LABORATORY SERVICES SERIES: A SAFETY PROGRAM FOR SERVICE GROUPS IN A NATIONAL RESEARCH AND DEVELOPMENT LABORATORY (1965-1974). Winget, R. H. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 31p. Dep. NTIS $4.00.

The experiences of a ten-year period of developing a safety program for craft and labor groups supporting a major laboratory are summarized with tabulations of types of injuries or accidents, improvements noted over the decade, and educational and safety recognition efforts. (auth)

7477 (SAAS-178) OCCUPATIONAL RADIATION EXPOSURE IN THE GDR IN 1971. Koenig, W.; Larssen, A.; Rothe, W. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). May 1975. 42p. (In German). Dep. NTIS (US Sales Only) $5.00.

In 1971 a total of 32,843 occupationally exposed persons were monitored by the central film badge service of the National Centre for Radiation Protection. The monthly over-exposures (more than 0.4 rad) totalled 685. In 40 cases the quarterly dose (3 rad) was exceeded during one month and 12 of these records could be assessed as real over-exposures. Most of the over-exposures could be attributed to an insufficient application of safety regulations. The results were analyzed according to type of institution and type and duration of employment as well as age of employees. (auth)

7478 NORMY RADIATSIONNOI BEZOPASNOSTI: NRB-69. (Standards of Radiation Safety: NRB 69). Burgasov, P. Moscow; Atomizdat (1972). 88p.

These radiation safety rules are introduced to replace the previous standards on maximum permissible levels of ionizing radiation (PDU 1960 year) presented in rules of operating with radioactive substances and sources of ionizing radiation No. 333-60. These rules are the sole official document describing conditions of radiation safety for individuals and the population as a whole in all enterprises of the Soviet Union. This second edition contains corrections to the first edition of NRB-69. The book lists the specific radioactive isotope, its half-life, the state of the isotope (soluble or insoluble), the critical organ, and maximum permissible amounts of radioactivity in air and water. (SJR)

7479 CYTOGENETIC CHROMOSOMAL ABERRATION DOSIMETRY METHOD AFTER RADIATION ACCIDENTS AND PROGNOSTIC SIGNIFICANCE OF STEREOTYPICALLY APPEARING CHROMOSOMAL ABERRATIONS AFTER RADIATION EXPOSURE. Bloennigen, K. A. Freiburg i. B.; Freiburg i. B. Univ. (1973). 16p. (In German). INIS.

Thesis.

The paper reports on a radiation accident involving an Iridium-192 rod of an activity of 7.8 Ci and a size of $2 \times 2 \times 2$ mm^3. The radiation source had remained in direct contact with the left hip and elbow of the examined person for a period of 45 minutes. On the points that had been directly exposed, physical values of 5,000 rad and 10,000 rad were measured while the whole-body dose was 100-200 rad and the gonad dose 300-400 rad. These values were confirmed by observations of the clinical course and haematological and andrological examinations. Chromosome analysis of lymphocytes produced values between 100 and 125 and thus a significant agreement with the values determined by physical methods. The findings suggest that the relatively simple and fast method of cytogenetic dosimetry provides a useful complementary method to physical dosimetry. (GE)

7480 FILM DOSIMETRY FOR THE IRRADIATION OF THE CILIARY BODY WITH FAST ELECTRONS. Schlechtweg, G. K. Erlangen, Ger.; Erlangen-Nuernberg Univ. (1973). 34p. (In German). INIS.

Thesis.

In the irradiation of the ciliary body of the eye with electrons, particular dosimetric problems arise due to the smallness of the irradiation field. The dose measuring (absolute and relative) can only take place in this case by film. A very insensitive film, new on the market, was tested for this purpose. Its properties during irradiation with electrons are examined and reported in the study. (GE)

7481 CRITERIA FOR DOSE CALCULATIONS IN RADIOIODINE-THERAPY. Voigt, C. Berlin; Freie Univ. (1973). 58p. (In German). INIS.

Thesis.

The problem of whether the therapeutic effect depends on a certain dose rate was investigated with 365 patients after a single treatment with radioiodine. Also investigated were the additional effects of the weight of the thyroid on radioiodine storage and half-life on the therapeutic results. However, no exact correlations between the therapeutic dose and the therapeutic effect could be proved. (GE)

7482 LIVER FUNCTION IN SURVIVORS OF THE ATOMIC BOMB. Gregory, P. B.; Amamoto, K.; Archer, P. G.; Rickert, R. R.; Omori, Y.; Bizzozero, O. J. Jr.; Hamilton, H. W.; Johnson, K. G. (Atomic Bomb Casualty Commission, Hiroshima). Radiat. Res.; 63: No. 3, 578-583 (Sep 1975).

Screening liver function tests were obtained in survivors of the atomic bomb and matched nonexposed controls. Subjects with test values greater than two standard deviations from the mean received a detailed clinical evaluation. There was no evident long-term effect of exposure to the atomic bomb on liver function, detectable clinical liver disease, or hepatic histology. (auth)

7483 SITES OF UNSCHEDULED DNA SYNTHESIS WITHIN IRRADIATED HUMAN LYMPHOCYTES. Berliner, J.; Himes, S. W.; Aoki, C. T.; Norman, A. (Depts. of Pathology and Radiological Sciences, Los Angeles). Radiat. Res.; 63: No. 3, 544-552 (Sep 1975).

The sites of unscheduled DNA synthesis (UDS) induced by ultraviolet or ionizing radiations in human lymphocytes are not randomly distributed in the nuclear DNA. Examinations of radioautographs of 1.0-mu m nuclear sections show that about 70 percent of the grains are over the 33 percent of the nuclear area adjacent to the nuclear membrane. This is found whether the bulk of the DNA, which is in heterochromatin masses, is peripherally distributed, is dispersed throughout the nucleus, or is homogeneously distributed. This peripheral distribution of UDS is maintained when incubation time is increased from 0.5 to 4 hr, and when cells are stimulated for 18 hr by phytohemagglutinin prior to irradiation. The distribution of UDS sites is not simply related to the distribution of euchromatin (active) or heterochromatin (repressed) within the nucleus. (auth)

7484 INDUCTION OF CHROMOSOMAL ABERRATIONS IN HUMAN LYMPHOCYTES BY X RAYS AND FISSION NEUTRONS: DEPENDENCE ON CELL CYCLE STAGE. Carrano, A. V. (Univ. of California, Livermore). Radiat. Res.; 63: No. 3, 403-421 (Sep 1975).

Human lymphocytes were irradiated in culture with several doses of 250 kVp x rays or fission neutrons (0.85 MeV average energy) either in the unstimulated state (G_0), at 17 hr after phytohemagglutinin stimulation (G_1), or at approximately 48 hr after stimulation. In the last case, the cells were labeled with tritiated thymidine prior to irradiation to distinguish S and G_2 cells. All cultures were harvested at two successive intervals between 48 and 58 hr. The frequencies of neutron-induced chromatid deletions in G_2 cells differed significantly among harvest times and definite trends were observed for other aberrations. Dose-response curves for chromosome type aberrations followed the classical aberration production model; chromatid aberrations exhibited more complex kinetics. The differential cell cycle response to aberration induction varied with radiation quality, dose, and aberration type. The relative biological effectiveness of fission neutrons for aberration production also varied with aberration type, cell cycle stage, and neutron dose but remained principally between 2 and 6. (auth)

7485 DISTRIBUTION OF THE ABSORBED DOSE IN HOMOGENEOUS TISSUE-EQUIVALENT MEDIUM AROUND A LINEAR SOURCE OF RADIOACTIVE COBALT. Pavlova, T. G. pp 143-145 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Calculations are made of the distribution of the absorbed dose in soft tissue around a linear ^{60}Co source. Experimental verification was made of the calculated values obtained. (JSR)

7486 EVALUATION OF THE INTEGRAL DOSE IN TISSUE REGIONS FROM LINEAR ^{60}Co SOURCES DURING INTRACAVITY THERAPY. Aleksandrova, L. N.; Palladieva, N. M. pp 145-148 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A computational method was developed for the determination of the integral dose in tumorous regions around individual linear sources and radiating systems most used in clinical practice. (JSR)

7487 VOLUME DOSE FIELD DURING GAMMA THERAPY. Krongauz, A. N.; Klepper, L. Ya.; Oleinik, Yu. A.; Fadeeva, M. A.

pp 155-158 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A computer calculation was made of the volume dose field during irradiation of cancerous sites of large area and during irradiation of the lungs with consideration of the lung inhomogeneity. The results obtained in the case of irradiation of the esophagus and the central region of the lungs are reported and discussed. (JSR)

7488 CALCULATION OF THE DISTRIBUTION OF THE ABSORBED ENERGY DURING LOCAL IRRADIATION WITH PROTON BEAMS. Voronin, Yu. V. pp 158-164 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

By use of an approximation method expressions are derived for calculation of the distribution of the absorbed energy during proton irradiation. The expressions are derived in the general form with consideration of the nuclear interaction which are substantial both for high precision in the determination of the RBE and for the determination of those characteristics of the quality of the irradiation such as the LET. (JSR)

7489 COMPARATIVE EVALUATION OF THE LEVELS OF EXTERNAL IRRADIATION OF DIFFERENT PROFESSIONAL GROUPS IN THE PEACEFUL USE OF ATOMIC ENERGY. Lyarskii, P. P.; Korenkov, I. P.; Miseitsev, P. I. pp 215-218 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The results of an evaluation of the monthly irradiation dose to various professional groups working with radiation and radioactive materials are tabulated in mR/month. (JSR)

7490 EVALUATION OF THE RADIATION SAFETY DURING WORK WITH SOURCES OF PENETRATING RADIATION FROM MATERIALS OF MANY YEARS OF PHYSIOLOGICAL STUDIES. Sel'tser, V. K.; Stepanov, A. I.; Loseva, N. V.; Katsnel'son, G. M. pp 219-224 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The results of 5 years of study on various physiological indices (bioelectrical activity of the brain and basic hemodynamic indicators) of professionally exposed and control groups are tabulated and discussed. The results indicate that extended professional irradiation cannot be detected by contemporary electrophysiological methods. (JSR)

7491 BASIC PROBLEMS IN CONTEMPORARY RADIOTHERAPY OF MALIGNANT TUMORS. Kozlova, A. V. pp 249-254 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A general discussion is presented of contemporary problems connected with the irradiation of healthy tissue surrounding the malignant tissue, determination and selection of the total and single dose, fractionated doses, and combined therapy with surgery or chemotherapy. (JSR)

7492 REMOTE GAMMA THERAPY OF CANCER OF THE CERVIX. Kostromina, K. N.; Pavlov, A. S.; Kvasov, V. A. pp 266-275 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The results are reported on the determinations of the dose field distribution during γ therapy of cancer of the cervix using specially shaped intracavity lead blocks to form the optimum dose field. Typical dose distributions are given. (JSR)

7493 EFFECTIVENESS OF EXTERNAL γ RADIATION OF THE "ROKUS" INSTALLATION DURING COMBINED RADIOTHERAPY OF CANCER OF THE CERVIX. Voznyuk, E. I.; Shvarts, V. M. pp 275-280 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A complex irradiation plan was developed based on the location and stage of the cancer. The results of the treatment of 87 cases are reported. The use of static irradiation of the lymphatic vessel in patients with stage II cancer of the cervix by a narrow field at a dose of 400 rad lead to complete disappearance of the infiltrate in 80.3% of the cases and to its significant reduction in 18.4% of the cases. The effects of remote γ therapy during irradiation (whole-body and local radiation reactions) are moderate. Subjective phenomena are rare and the reduction of the quantity of leukocytes is moderate and occurs principally because of lymphocytes. A comparative increase of the quantity of eosinophiles is observed often at the end of the irradiation. In connection with the presence of moderate leukopenia, lymphocytopenia, and hypoalbumin, a generally strengthening therapy and periodic blood transfusions are necessary. (JSR)

7494 RESULTS OF IRRADIATION OF PATIENTS WITH CANCER OF THE ESOPHAGUS BY BREMSSTRAHLUNG FROM THE 4.3-MeV ACCELERATOR WITH USE OF THE USUAL METHODS OF IRRADIATION AND OF OPTIMUM PLANNING. Gerasimyak, V. G.; Palladieva, N. M.; Pruchanskii, V. S.; Rabinovich, R. M.; Sinitsyn, R. V. pp 280-284 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The clinical results obtained in the bremsstrahlung irradiation of 93 patients with cancer of the esophagus and the associated dosimetric data are reported. One group of patients were irradiated by the generally accepted methods using three and four fields. The irradiation conditions for the other group were selected by the method of optimum planning using the simplex calculation method for computers. Comparative clinical-dosimetric data from both groups showed that the use of the computational method for selection of optimum irradiation conditions made it possible to completely individualize the development of the dosimetric plan with consideration of the functional state of the organs of the patient. The spread of the calculated focus dose was determined usually by the location and propagation processes and, consequently, by the condition of the patient and individual biometric data. Optimum planning made it possible to construct the dose field in each case. (JSR)

7495 MEGAVOLT RADIOTHERAPY OF A LOCALIZED FORM OF MALIGNANT LYMPHOMAS. Pavlov, A. S.; Ankudinov, V. A. pp 285-290 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A radical program of localized megavolt therapy using the 5-MeV electron linear accelerator and ^{60}Co sources was developed for therapy of malignant lymphomas. The essence of the method consisted in the irradiation of both the primary site of the lymphoma and the zone of subclinical changes of the lymphatic nodes in the chest and peritoneal cavity. The time lapse (3 years) is not yet sufficient to judge the effectiveness of the method, but preliminary results are promising. (JSR)

7496 ROLE OF TELEGAMMA THERAPY AND RADIOACTIVE IODINE IN TREATMENT OF CANCER OF THE THYROID GLAND. Kiseleva, E. S.; Falileeva, E. P. pp 291-293 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The results obtained in the treatment of thyroid gland cancers by pre- or post-operative telegamma therapy of the primary tumor and regional metastases and in the treatment of metastases located in various areas of the body were reported. Good results were obtained in the combined therapy in the case of local metastases. In the case of lung metastases treatment with ^{131}I gave good results. Very promising results were obtained in patients with residual tumors of the thyroid after treatment with radioiodine. The results obtained in the case of bone metastases were much less promising. (JSR)

7497 COMPARATIVE EVALUATION OF LONG-TERM RESULTS FROM DIFFERENT METHODS OF RADIOTHERAPY OF THE MEDULLARY REGION. Lokshina, A. M. pp 293-295 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A comparative evaluation was made of two irradiation methods:

a multicourse fractionated irradiation and a single course fractionated irradiation. The multicourse irradiation was made under conditions of classical x-ray therapy. The single course fractionation was carried out on the GUT-Co-400 installation with individualized planning of the radiotherapy. Both irradiation methods were combined with surgical treatment. The combined treatment with multicourse irradiation resulted in prolongation of life and of the period before the reappearance of symptoms of recurrence or metastases. (JSR)

7498 CONDITION OF THE BLOOD VESSELS OF THE LUNGS AFTER γ- AND X-RAY THERAPEUTIC IRRADIATION OF BRONCHIAL CANCER. Val'kovich, E. I.; Stankevich, N. V.; Funshtein, L. V. pp 295-297 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The effects of γ and x-ray therapy of bronchial cancers on the blood vessels of the upper part of the lungs were studied. Two independent forms of damage of the blood vessels were observed occurring with each other. One is similar to the teleangiectasia of small blood vessels in delayed periods after re-irradiation of the skin. The other can be described as different degrees of fibrosis of the large blood vessels. (JSR)

7499 DEVELOPMENT OF TECHNOLOGICAL PROCESSES AND SHIELDED EQUIPMENT FOR SETS OF SEALED SOURCES IN CONTEMPORARY RADIOLOGICAL DIVISIONS. Bogoudinov, R. D.; Frosin, V. N.; Lagunova, I. G.; Dmokhovskii, V. V. pp 306-312 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The principles of a scheme for handling sealed radiosources in a radiological division in order to shield the personnel as completely as possible are outlined. The scheme discussed includes both the procedures to be followed and the equipment used in handling sealed sources. The areas in which the possibility of exposure are greatest are indicated and the precautions to be taken are given. The complex designed on the basis of these considerations is briefly described. (JSR)

7500 MEDICAL-BIOLOGICAL REQUIREMENTS DURING THE CONSTRUCTION AND OPERATION OF RADIATION INSTALLATIONS Leshchinskii, N. I. pp 341-345 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Problems of safety in the use of radioactive materials and particle accelerators which must be considered in their design, construction, and operation are reviewed. Groups of personnel working with these installations are identified with respect to the possibility of their exposure and the safety precautions which must be incorporated in radiation installations to prevent exceeding the maximum permissible dose are outlined. (JSR)

7501 NEW METHOD OF PROGRAMMED OPERATION OF THE GAMMA THERAPEUTIC APPARATUS ROKUS. Marova, Yu. M.; Seregina, I. P.; Trius, E. B.; Khrushchev, M. M.; Raifel, B. A. pp 358-361 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A computer program was developed for planning the course of the radiotherapy and carrying it out. The program draws a cross section of the site to be irradiated through all layers of tissue, automatically converts this information so that it can be put on perforated cards, calculates the optimum regime of irradiation, and automatically carries out this regime. With this program fractionated doses can be exactly the same in each session. (JSR)

7502 HYGIENIC EFFECTS OF THE MECHANIZATION AND SCIENTIFIC ORGANIZATION OF THE WORK OF MEDICAL PERSONNEL OF RADIOLOGICAL INSTITUTIONS. Aleksandrov, N. N.; Zhakov, I. G.; Zverev, F. P.; Sukovatykh, L. S.; Shitikov, B. D. pp 368-373 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A series of new technical devices were developed, constructed, and put into use for work with open and sealed radioactive sources in radiological institutions. These included devices for transportation of the sources and shielding. Isodose curves for the spatial distribution of γ radiation in treatment areas, and evaluation of professional exposure using these new devices were made. (JSR)

7503 NEUTRON-ACTIVATION AUTORADIOGRAPHY IN MEDICINE. Ryabukhin, Yu. S.; Zaichik, V. E. pp 381-387 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Neutron-activation radiography can be used in two areas: registration of delayed radiation after neutron irradiation and registration of the prompt radiation or of short-lived radioisotopes. The use of reactor neutrons in both areas of radiography is discussed. The interferences arising in both cases are examined. Calibration curves and examples of autographs obtained after neutron irradiation are given. (JSR)

7504 APPARATUS FOR THE INTRA-CAVITY IRRADIATION OF MALIGNANT TUMORS. Rimman, A. F.; Sul'kin, A. G.; Shtan, A. S.; Komar, V. Ya.; Zhukovskii, E. A.; Elisyutin, G. P. pp 423-429 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A brief review is given of advances made in the development and perfecting of intra-cavity irradiation devices. On the basis of the principles discussed in the works cited some experimental devices, designed particularly for irradiation of gynecological tumors, were developed and constructed. It is very briefly described. (JSR)

7505 RADIOISOTOPIC APPARATUS FOR CLINICAL PURPOSES. Sul'kin, A. G.; Taborovskii, I. K. pp 429-436 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A review is given of the history of the development in the USSR of radioisotopic devices. The characteristics of a universal gamma therapy device were outlined and contrasted with those of a device for special applications. The outfitting of a gamma therapy cabinet is discussed. The characteristics of radioisotopic diagnostic apparatus are considered in slightly more detail. (JSR)

7506 TREATMENT OF OAT-CELL CARCINOMA OF THE LUNG. Bates, M. (North Middlesex Hospital, London). Am. Heart J.; 89: No. 5, 675-677(May 1975).

The efficacy of pre-operative radiotherapy followed by surgery in the treatment of oat-cell carcinoma (lung) is discussed. The radiation dose is limited to 2000 rads to avoid lung complications such as radiation pneumonitis. (ERB)

7507 81 AND 31 keV ^{133}Xe PHOTONS FOR SOFT TISSUE COMPONENT ANALYSIS BY DIFFERENTIAL ABSORPTION. Preuss, L. E.; Bolin, F. P.; Piper, D. G.; Bugenis, C. K. (Edsel B. Ford Inst. for Medical Research, Detroit). Int. J. Appl. Radiat. Isot.; 26: No. 6-7, 329-332(Jun 1975).

The 31 and 81 keV radiations from ^{133}Xe were successfully used in dual beam absorptiometry for determination of tissue lipid and lipid-free fractions. The two primary radiations are amenable to filtering, and sufficient monochromaticity is obtainable for differential absorption studies. Fat and fat-free tissue ratios have been analyzed with a comparable accuracy to that found with ^{109}Cd and ^{125}I–^{241}Am systems. ^{133}Xe's short half life is a disadvantage; but the penetration, low cost, and ubiquitous nature of this isotope make it a source candidate for in vivo fat-lean fraction determinations. (auth)

7508 RADIATION PROTECTION AND THE CONTROL OF ENVIRONMENTAL POLLUTANTS. Pochin, E. E. (University Coll. Hospital Medical School, London). Int. J. Environ. Stud.; 4: No. 3, 213-217(Mar 1973).

The very extensive radiobiological and epidemiological investigations into the effects of ionizing radiation have given a basis for estimating the hazard that is likely to be involved in different levels of human exposure. It is, therefore, possible to indicate the maximum exposures that appear justifiable, as ensuring adequate safety in various circumstances in which some exposure is unavoidable. In principle, similar quantitative criteria are required for a variety of pollutants, to indicate the urgency for controlling the release of each into the general or working environment, and the level below which each must be kept to ensure adequate safety. The more we can develop and utilize any available quantitative estimates of the

toxicity of different pollutants, the more effectively can priorities and procedures be established for dealing appropriately with such materials, under any conditions in which some pollution is unavoidable. (UK)

7509 ABSENTEEISM AMONG SURVIVORS OF THE ATOMIC BOMBING OF HIROSHIMA. Meigs, J. W. (Yale Univ., New Haven); Meigs, C. R.; Blot, W. J.; Inoue, S. Br. J. Ind. Med.; 32: No. 3, 193-202(Aug 1975).

Atomic bomb survivors who worked at the Atomic Bomb Casualty Commission in Hiroshima during the years 1968-71 and held handbooks identifying them as survivors took significantly more days of both annual leave and sick leave than did matched and paired control subjects. These differences in leave-taking patterns are considered to be due to behavioral causes as they could not be attributed to radiation dose-response effects. (auth)

7510 INTERNATIONAL COMMISSION OF RADIATION UNITS AND MEASUREMENTS. Wyckoff, H. O. (International Commission on Radiation Units and Measurements, Washington, DC). Radiol. Prot. Bull.; No. 12, 9-12(Jul 1975).

A brief survey of the history, objectives and structure of the International Commission on Radiation Units and Measurements (ICRU) since its formation in 1925 is followed by a more detailed consideration of ICRU's current objectives. ICRU's work is now carried out in close cooperation with the International Commission on Radiological Protection (ICRP) and relationships have been developed with other international organizations such as the World Health Organization and the International Atomic Energy Agency. Financial contributions have come from many different sources. ICRU Reports, both currently available and in the process of preparation, are listed, and constructive comments and suggestions regarding its recommendations and reports are invited by the author. (UK)

7511 RADIOLOGICAL PROTECTION IN DENTISTRY: THE NEW SERVICE AFTER ONE YEAR'S OPERATION. Hudson, A. P. (National Radiological Protection Board, Leeds, Eng.). Radiol. Prot. Bull.; No. 12, 20-24(Jul 1975).

The National Radiological Protection Board has carried out an assessment of dental x-ray equipment and radiography procedures, in terms of compliance with the "Code of Practice for the Protection of Persons against Ionizing Radiations arising from Medical and Dental Use" (HMSO 1972). A postal service has been developed, to reduce the high cost and inconvenience to dentists of an earlier survey based on personal visits. The three-year contract period of the postal service incorporates a questionnaire together with trial exposures of films and special postal cassettes by the dentist, followed by the preparation of a Radiological Safety Report. Radiation monitoring films are provided during the contract period for all dental staff concerned with radiography. During the first year of operation requests were received for checks on 375 dental x-ray sets, and the findings and recommendations from 347 Radiological Safety Reports are summarized. The limitations of the remotely operated postal service are acknowledged, but they are far outweighed by the advantages of the more extensive range of the survey. (UK)

7512 BOARD'S NEW HEADQUARTERS. Roberts, G. C. (National Radiological Protection Board, Harwell, Eng.). Radiol. Prot. Bull.; No. 12, 6-8(Jul 1975).

The National Radiological Protection Board's headquarters have now been established in purpose-built accommodation at Harwell, on a site in the immediate vicinity of the Atomic Energy Research Establishment, the Medical Research Council's Radiobiology Unit and the Science Research Council's Rutherford Laboratory. Factors such as cost, special facilities to be provided within the building, convenience and flexibility of the accommodation, and the mode and speed of construction together with the possibility of phased occupation were all taken into consideration at the design stage. Low radiation background rooms are remote from areas where large radiation dose rates might be generated, and these rooms are enclosed by a thickness of six inches of steel of First World War vintage. Other building materials and ancillary equipment used in this area were also selected to minimize radiation levels. The animal house, neutron generator, instrument calibration cells and facilities for the Board's TLD-based personal dosimetry service and associated computer linkage to a national record-keeping service are briefly described. (UK)

7513 MEASUREMENTS OF AUTOMATICALLY CONTROLLED EXPOSURE RATE IN RADIODIAGNOSTIC SCREENING UNITS. Henshaw, E. T. (Mersey Regional Health Authority, Liverpool); Kennedy, J. Br. J. Radiol.; 48: No. 572, 680-682(Aug 1975).

Two similar surveys have been conducted in hospitals in Glasgow and the Mersey Region in order to investigate the levels of exposure rate at which the automatic controls were set on radiodiagnostic screening units. The results from both surveys give rise to concern. Measured automatic exposure rates on machines where the automatic control operates on both tube current and kilovoltage are tabulated and show that screening units operating under the same conditions of automatic control may be set at widely differing levels of exposure rate at the input of the intensifier. Frequently, the exposure rates are well in excess of the values at which the manufacturers claim to install them. Further investigation of the higher levels of exposure rate recorded in these tables revealed that these could be caused by aging of the intensifier, misalignment of the feedback device or errors in the installation and servicing of the control circuitry. The results of the two surveys show that a careful check needs to be made when a screening unit is installed so that automatically controlled exposure rates are not set to unnecessarily high levels. Such checks need to be repeated at regular intervals by the Radiological Protection Adviser. It would seem desirable that maximum levels of exposure rate be stipulated in the Code of Practice for the Protection of Persons against Ionizing Radiations. Close cooperation between radiologist, installation engineer and Radiological Protection Adviser is particularly important when an automatically controlled system is installed. Finally, it is desirable that at least tube kilovoltage and current values be continuously indicated to the radiologist. An indication of exposure rate to the patient rather than tube current would be more satisfactory. (UK)

7514 ABUSE OF SOURCES FROM FIRE DETECTORS. Croft, J. R. (National Radiological Protection Board, Leeds, Eng.). Radiol. Prot. Bull.; No. 12, 25-27(Jul 1975).

An instrument technician, interested in potholing and caving, located "up to 50" fire detectors on a rubbish tip in 1971. Aided by an old geiger counter, he identified and detached approximately ten foils, each containing 2.5 μCi radium from the inner chambers of these detectors. Working in the garage of his home, he constructed a "home-made" radium source, using a small wax-sealed ignition tube as a container for the foils. He then attempted a "tracer experiment" in an underground water course, dangling the sealed tube in the water in the hope that the water would become activated. The source contained 18 μCi radium. In spite of the discrepancy with the 25 μCi originally removed, there was no detectable contamination of the garage or bedroom above 3.10^{-6} μCi cm^{-2} and the technician's body content was less than 1.0 μCi radium, the limits of detection by the available methods. The newspaper covering protecting the garage workbench had earlier been disposed of via the dustbin. The technician was lucky not to have taken in a significant proportion of a maximum permissible body burden of radium. The original disposal of the radioactive material gives rise to most concern. The rubbish tip was accessible to the public, and the Department of the Environment had not issued any disposal authorization. It is recommended that although the legal onus falls on the user, the suppliers of these fire detectors should acquaint the users with the appropriate legislation. (UK)

7515 BOOKSHELF ON RADIOLOGICAL HEALTH. Wilms, H. G.; Moss, C. E. (Dept. of Health, Education, and Welfare, Rockville, MD). Am. J. Public Health; 65: No. 11, 1231-1237 (Nov 1975).

This bookshelf is an attempt to list, categorize, and present details on the many varied sources of information available to personnel working in the field of radiological health. This particular bookshelf will not cover those sources listed in a previous publication (Bureau of Radiological Health Training Publication TP-198), but will concentrate on those sources published or revised after 1965. It is hoped that this bookshelf will help schools, public health officials, teachers, students, and others in updating their existing sources of information. It is obvious that any such attempt at developing a master list of this type has to contain only representative sources of information. The authors invite readers to inform them of any omissions or errors. Finally, this bookshelf attempts, where applicable, to restrict the number of sources to those more associated with public health aspects. The bookshelf is divided into four main sections. They are textbooks, current literature, training and educational materials, and other sources. Each one of these sections is further stratified into additional details. (auth)

Vertebrates

Refer also to abstract 7608.

7516 (AED-CONF-75-169-004) RADIATION EFFECTS AND AGEING. Cottier, H.; Buerki, H.; Gautschi, J. R.; Pe-

drinis, E.; Luscieti, P.; Ruchti, C.; Zimmermann, A. (Bern Univ. (Switzerland). Pathologische Inst.). 1975. 23p. (In German). INIS.

From 59th meeting of the Deutsche Gesellschaft fuer Pathologie and 24th meeting of the Europaeische Gesellschaft fuer Veterinaerpathologie; Kiel, F. R. Germany (19 May 1975).

3 figs.; 1 tab.; 52 refs. With abstract in English and German. Available from ZAED.

This review deals with late somatic effects of ionizing radiation, mainly following whole body exposure, and their partial resemblance to what is generally referred to as "premature and/or accelerated ageing." Emphasis is given to results indicating that no all age-dependent diseases or degenerative disorders are hastened by radiation. Mention is made of ongoing, large-scale experiments in various laboratories dealing with effects of protracted external radiation by fission neutrons and gamma rays which may be a hazard in view of the developing reactor industry. For the same reason, long-term effects of inhaled radionuclides are briefly reviewed. (GE)

7517 (CONF-750671-2) RADIOBIOLOGIC EFFECTS AT LOW RADIATION LEVELS. Casarett, G. W. (Rochester Univ., N.Y. (USA). School of Medicine and Dentistry). 1975. 14p. (UR-3490-832). Dep. NTIS $4.50.

From international symposium on areas of high natural radioactivity; Pocos de Caldas, Brazil (16 Jun 1975).

Data are reviewed on the effects of low radiation doses on mammals. Data from the 1972 report on the Biological Effects of Ionizing Radiation issued by the Advisory Committee of the National Academy of Sciences and National Research Council are discussed. It was concluded that there are certain radiosensitive systems in which low doses of radiation may cause degenerative effects, including gametogenic epithelium, lens of the eye, and developing embryos. Despite extensive investigation of genetic effects, including chromosomal effects, neither the amount of change that will be caused by very low levels of irradiation nor the degree of associated detriment is known. (CH)

7518 (CONF-751126-1) INTER-SPECIES COMPARISON OF THE RESPONSES OF MICE AND DOGS TO CONTINUOUS ^{60}Co gamma-IRRADIATION. Norris, W. P.; Tyler, S. A.; Sacher, G. A. (Argonne National Lab., Ill. (USA)). Nov 1975. Contract W-31-109-Eng-38. 15p. (SM-202/524). Dep. NTIS $4.50.

From IAEA international symposium on biological effects of low level radiation pertinent to protection of man and his environment; Chicago, Illinois, USA (3 Nov 1975).

Young-adult, purebred, beagle dogs were exposed continuously, 22 hours/day, to ^{60}Co gamma-rays until they died. The daily dose rates ranged from 3.5 to 210 rad. At 3.5 rad/day the mean survival time was in excess of 1860 days (the study is still in progress), while at 210 rad/day mean survival time was 13 days. The data are compared to those from previously published information from similarly irradiated mice. (CH)

7519 (COO-3267-08) RADIATION-INDUCED CHROMOSOMAL INVERSIONS IN MICE. Progress Report, 1 June 1974–31 May 1975. Bailey, D. W.; Womack, J. E. (Jackson Lab., Bar Harbor, Maine (USA)). 31 May 1975. Contract E(11-1)-3267. 16p. Dep. NTIS $4.50.

Progress is reported on studies of chromosomal inversions in the sperm of mice induced by irradiation or by a chemical mutagen. (CH)

7520 (COO-3267-09) RADIATION-INDUCED CHROMOSOMAL INVERSIONS IN MICE. Progress Report, 1 June 1972–31 May 1975. Bailey, D. W.; Womack, J. E. (Jackson Lab., Bar Harbor, Maine (USA)). 31 May 1975. Contract E(11-1)-3267. 9p. Dep. NTIS $4.50.

Progress is reported on studies of chromosomal inversions in the sperm of mice induced by irradiation or by a chemical mutagen. (CH)

7521 (LBL-4708) INFLUENCE OF CELL DISSOCIATION PROCEDURES ON THE TUMORIGENICITY OF SIMIAN VIRUS 40 TRANSFORMED FIBROBLASTS. Tenforde, T. S.; Risius, J.; Beckmann, A.; Tobias, C. A.; Gurney, E. (California Univ., Davis (USA). Dept. of Engineering). Nov 1975. Contract W-7405-ENG-48. 15p. Dep. NTIS $4.00.

Mouse fibroblasts transformed by Simian Virus 40 (SV40) were examined for tumor forming ability in syngeneic BALB/c mice following dissociation from tissue culture dishes by two procedures. A significantly greater in vivo proliferative capacity was observed for cells dissociated by the tryspin-EDTA procedure, with the injected cell dose for tumor production in 50 percent of recipient mice (the TPD_{50}) being 16-fold lower than the TPD_{50} for cells dissociated by the EDTA procedure. Host immunosuppression with 300 rad whole-body gamma irradiation led to a significant 7-fold decrease in the TPD_{50} for cells dissociated by the EDTA procedure, while no significant decrease in TPD_{50} was observed for cells dissociated by the tryspin-EDTA procedure. (auth)

7522 RADIATION INJURIES OF THE SPINAL MARROW OF RATS AFTER IRRADIATION WITH FAST ELECTRONS. Bruce-Micah, B. Saarbruecken, Ger.; Univ. des Saarlandes (1973). 44p. (In German). INIS.

Thesis.

Twenty rats were irradiated in fractions on five days of the week with fast electrons of 42 MeV with a single dose of 200 r/day. After 1,000 r, 2,000 r, 3,000 r and 4,000 r HD, the animals were supravitally fixed and the spinal marrow was removed. The histological investigation showed after 1,000 r HD distinct changes of the nerve cells and nerve fibers whereas the vessels appeared not to be injured. After 2,000 r HD, vessel changes with edemas occured for the first time. After 3,000 r HD, all nerve cells were severely injured, the glia tissue was denser and the vessels were enlarged despite endothelial proliferations. Furthermore, there were big edemas around the vessels and a beginning of demyelinisation in the dorsal column. After 4,000 r HD, a great part of the nerve cells and also a few glia cells were destroyed. The remaining glia cells were pyknotic and had several nucleoli. The tractus of the white matter consisted almost only of a glia felt. With a survival time of six weeks, the glia had greatly regenerated and numerous new capillaries had sprouted in the grey matter. The white matter was strongly demyelinised. In the front lateral column, small round necrosis centers were visible. 18 weeks after irradiation, the glia tissue had greatly rebuilt itself. There were only very few nerve cells present. The strong sprouting of new capillaries in the grey matter was most noticeable. The results show that the application of fast electrons is of no advantage as regards injuring the nerve tissue compared to X-rays. (GE)

7523 STRUCTURAL AND HISTOCHEMICAL DEVELOPMENT OF THE RAT RETINA AND ITS INTERRUPTION BY 200 kV X-RAYS. Schulenburg, B. Hamburg; Hamburg Univ. (1972). 17p. (In German). INIS.

Thesis.

The retina of 1, 6, 11, and 21 day-old rats of both sexes were microscopically examined after treatment by various histochemical methods. This was done in the nonirradiated state as well as 24 hours after conventional X-ray irradiation with 500 and 1,000 R in order to detect early radiation reactions. With 1 and 6 day-old animals, necrobiosis, destruction of the cell cluster and rosette formation in the unit granular layer as a result of irradiation determine the histological picture. After irradiation on the 11th day of life however, a slight glycogen accumulation in the inner retina layers comes to the fore as a sign of an interrupted carbohydrate utilization. With 21 day-old rats, a chromatolysis in the optical ganglion cells is found as a radiation reaction. (GE)

7524 α-MICRODOSIMETRY IN BONE SECTIONS BY MEANS OF DIELECTRIC TRACK DETECTORS AND ELECTRONIC IMAGE ANALYSIS. Polig, E. (Kernforschungszentrum, Karlsruhe, Ger.). Int. J. Appl. Radiat. Isot.; 26: No. 8, 471-479(Aug 1975).

The track diameter kinetics and variation of efficiency with etching time for 20°C and 30°C etching temperature were determined for cellulose nitrate detectors and explained theoretically. With planar ^{239}Pu sources and bone slices of varying thickness the efficiency as function of source-detector distance was measured and allowed the computation of a factor converting track density to dose rate for tissue sections with arbitrary thickness. Moreover, the dependence of selfabsorption on the thickness of the bone section and of the absorber was evaluated. The scan of a bone section from the femur of a rat injected with ^{241}Am demonstrates the application of the procedure for dose rate determinations with an image analyzing system. (auth)

7525 PHARMACOLOGIC EFFECTS OF FLAVONOIDS ON BLOOD VESSELS. Gabor, M. (Univ. Medical School, Szeged). Angiologica; 9: 355-374(1972).

This paper has dealt with the effects of flavonoids on the blood vessels in 5 parts. Part I treats the effects on the dimensions of the vessels, and Part II studies on isolated blood vessels. Part III gives an account of the effects of flavonoids on increased capillary permeability induced by chloroform, histamine, serotonin, bradykinin, heat and x rays. It also deals with the examination of the decrease of permeability by a radioisotope method, and with the effects of flavonoids on histamine-induced eye chemosis and on experimentally-induced paw oedema. Part IV reports the effects of various flavone derivatives on capillary resistance, and part V the mechanism of action of flavonoids. (auth)

7526 EXPERIMENTAL THYROID TUMORS. Doniach, I. Monogr. Neoplast. Dis. Various Sites; 6: 73-99(1970).

A summary is presented of a number of experiments conducted on the induction of experimental thyroid tumors. Among the studies included are: goitrogen-induced tumors in rats; goitrogen-induced tumors in mice; metastases of TSH-dependent tumors; tumor induction by combined acetylaminofluorene and goitrogens; tumor induction by dietary iron deficiency; tumors induced by ^{131}I, x rays; and combined radiation and goitrogens; and tumors induced by partial thyroidectomy. (ERB)

7527 INCREASED RADIOSENSITIVITY OF RAT RHABDOMYOSARCOMA CELLS INDUCED BY PROTRACTED IRRADIATION. Kal, H. B.; Barendsen, G. W.; Bakker-Van Hauwe, R.; Roelse, H. (Radiobiological Inst. TNO, Rijswijk, Netherlands). Radiat. Res.; 63: No. 3, 521-530 (Sep 1975).

Cells of a solid rat rhabdomyosarcoma, which can be cultured in vitro and upon inoculation grow in vivo into new tumors, were irradiated at low dose rates in vitro or in vivo. Assays of fractions of clonogenic cells show that repair of sublethal damage takes place during protracted irradiation. Nevertheless an acute single dose administered at the end of a protracted irradiation of many hours is more effective with respect to induction of cell lethality than a single acute dose applied without pretreatment. This increased radiosensitivity at the end of a low dose rate treatment can be explained however by the observation based on DNA measurements, that cells were redistributed over the cell cycle phases with relatively more cells in the G_2 + M phase. (auth)

7528 RESPONSE OF THE PRONUCLEAR MOUSE EMBRYO TO X IRRADIATION IN VITRO. FuFrain, R. J.; Casarett, A. P. (Cornell Univ., Ithaca, NY). Radiat. Res.; 63: No. 3, 494-500 (Sep 1975).

Zygotes from superovulated hybrid C57BL/10J x SJL/J F_1 mice were flushed from the oviducts 24 hr after the HCG injection. Pronuclear stage embryos were selected, cultured, and observed for a total of six days in microdrops of a chemically defined medium at 37°C in an atmosphere of 90 percent nitrogen, 5 percent oxygen, 5 percent carbon dioxide. At 28 hr after the HCG injection, the late pronuclear stage embryos were irradiated at exposures ranging from 50 to 600 R using a 280 kVp Picker x-ray machine (80 R/min, 0.5 mm Cu + Al parabolic filters). As determined by logistic analysis of the survival data, the ED_{50} values were 757 +- 69 R for development to the two-cell stage and 126 +- 27 R for development to the expanded blastocyst stage. An analysis of the times of the first two cleavages following irradiation indicated a dose-dependent cleavage delay of 0.85 min/R in the second cleavage following late pronuclear irradiation from exposures up to 600 R. These experiments illustrate that immediate arrest of cleavage, delay in the subsequent cleavages, and failure to undergo initial differentiation all result from irradiation of the pronuclear zygote. Use of the in vitro culture system allows a precise quantification of the degree of radiation-induced cleavage delay. (auth)

7529 RADIATION RESPONSE OF CLONOGENIC CELL POPULATIONS SEPARATED FROM A FIBROSARCOMA. Grdina, D. J.; Basic, I.; Mason, K. A.; Withers, H. R. (Univ. of Texas, Houston). Radiat. Res.; 63: No. 3, 483-493 (Sep 1975).

Five populations of cells from a murine fibrosarcoma were separated in continuous gradients of Renografin in the density range of 1.05 to 1.18 g/cm^3. The clonogenicity of these cells was determined using a lung colony assay. The cell populations collected at densities between 1.05 and 1.09 were the more clonogenic. The radiation response of unseparated control cells and cells in each of the five separated populations was studied. The D_0's ranged from 132 to 207 rad, the larger values being associated with the denser populations. The extrapolation numbers also varied; the higher values were found for the lighter populations. Only the population of cells banding at a density of 1.08 showed a response similar to that of the control, and this population was found to be the most clonogenic. (auth)

7530 INFLUENCE OF WHOLE-BODY IRRADIATION ON CALCIUM AND PHOSPHATE HOMEOSTASIS IN THE RAT. Pento, J. T.; Kenny, A. D. (Univ. of Missouri, Columbia). Radiat. Res.; 63: No. 3, 468-473 (Sep 1975).

Previous irradiation studies have revealed marked alterations in calcium metabolism. Moreover, the maintenance of calcium homeostasis with parathyroid hormone or calcium salts has been reported to reduce radiation lethality. Therefore, the present study was designed to evaluate the influence of irradiation on calcium homeostasis in the rat. Nine hundred rad of whole-body irradiation produced a significant depression of both plasma calcium and phosphate at 4 days postirradiation. This effect of irradiation was observed to be dose-dependent over a range of 600 to 1200 rad, and possibly related to irradiation-induced anorexia. The physiological significance of these observations is discussed. (auth)

7531 EARLIER ONSET OF HEMATOPOIETIC DIFFERENTIATION AFTER EXPANSION OF THE ENDOGENOUS STEM CELL POOL. Boggs, S. S.; Boggs, D. R. (Univ. of Pittsburgh). Radiat. Res.; 63: No. 1, 165-173 (Jul 1975).

In previous studies of growth and differentiation of endogenous hematopoietic spleen colonies (E-CFU), the time of resumption of differentiation after irradiation was increasingly delayed, but the rate of growth of the E-CFU compartment was not affected as the radiation dose was increased. These results suggested that differentiation might not occur until a critical stem cell pool size was attained. To further study this question, mice were injected prior to irradiation with substances which increase the E-CFU compartment; foreign plasma and endotoxin. Mice were injected daily for 4 days with human plasma or once with S. typhosa endotoxin 1 day prior to exposure to 580, 670, 770, 860, or 960 rads, and killed 3 to 10 days after irradiation. Plasma injection hastened the resumption of erythropoiesis, as measured by increased iron uptake, by about 5 days and endotoxin injection by about 3 days. Spleen weight and colony counts also increased earlier in treated mice. For each increment of 100 rads the time of onset of erythropoiesis was delayed an average of 1.5 days. The data are in accord with the concept that onset of differentiation after irradiation is geared to stem cell pool size. (auth)

7532 DAILY D–T NEUTRON IRRADIATION OF MOUSE INTESTINE. Hendry, J. H.; Major, D.; Greene, D. (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Radiat. Res.; 63: No. 1, 149-156 (Jul 1975).

The intestinal microcolony assay technique, for measuring damage to the progenitor cell population of mouse jejunal epithelium, has been used to demonstrate the following: Single doses of collimated 14-MeV D–T neutrons (10 to 30 rad min^{-1}) are more effective than single doses of 300-kV x-rays or Cs-137 gamma-rays (30 to 650 rad min^{-1}) by a factor of 1.9 to 2.3 for a reduction in crypt numbers of 50 to 80 percent. For mice irradiated at 10 cm deep in a 30-cm-deep water phantom, the above RBE values are reduced by about 9 percent. The same reduction is applicable for single doses and for four daily dose fractions. With daily fractionated irradiations (up to 5), the iso-effect curves (for 50 percent or 80 percent crypt number depopulation) are linear on a log/log plot, with slope exponents of 0.57 to 0.58 (gamma-rays) and 0.32 to 0.34 (neutrons). Estimates of the RBE values for extended fractionated dose regimens are 3.3 (10 daily fractions) and 3.6 (15 daily fractions). (auth)

7533 EFFECT OF X IRRADIATION ON THE ANEMIA—ERYTHROPOIETIN RELATIONSHIP IN DOGS. Gertzog, J. (Univ. of Rochester, NY); Kaufman, G. E.; Michaelson, S. M.; Huff, J. E. Radiat. Res.; 63: No. 1, 130-139 (Jul 1975).

The relationships between severity of anemia and plasma erythropoietin titer were determined for dogs made anemic through phlebotomy or through whole-body x-irradiation. No difference was seen between radiation survivors and phlebotomized dogs. Supralethally irradiated dogs showed a marked decrease in erythropoietin production. (auth)

7534 EFFECT OF IN VIVO X IRRADIATION ON DNA AND HISTONES OF RAT THYMUS NUCLEI. Bauer, R. D.; Oliphant, E. E.; Reeve, J. R. (California State Univ., Long Beach). Radiat. Res.; 63: No. 1, 119-129 (Jul 1975).

Changes in both the DNA and histone content of the nuclei isolated from rat thymus were followed for up to 24 hr after lethal whole-body irradiation of the animals. The number of nuclei or nuclear masses remained quite constant after the irradiation although both the DNA and histone content fell to approximately 20 percent of that found in the nonirradiated controls. Electron photomicrographs of the nuclei and nuclear remains are presented. The ratio of the DNA to histone remained constant in the nucleoprotein during the course of this study. From gel electrophoresis analyses, it appears that there is no significant selectivity in the manner or sequence in which the histone fractions are lost from the nuclei. The loss of both DNA and histone from the thymus seems to result from a gradual and nonspecific degradation of the individual nuclei influenced by the irradiation. (auth)

7535 PERITONEAL EXUDATE CELLS. III. Effect of Gamma Irradiation on Mouse Peritoneal Colony-Forming Cells. Lin, H. S. (Washington Univ. Medical School, St. Louis). Radiat. Res.; 63: No. 3, 560-566 (Sep 1975).

The effect of gamma irradiation on the proliferative capacity of peritoneal exudate colony-forming cells in agar was investigated. The values of D_0 obtained from the in vitro and in vivo irradiation studies were 110 and 118 rad, respectively. The recovery of the inducibility by thioglycollate medium of colony formation by cells in the peritoneal cavity of irradiated mice was also studied. A rapid initial recovery four days after irradiation was followed by a marked second depression in the number

of colony-forming cells; numbers returned to near control value at day 17. (auth)

7536 CYCLIC X-RAY RESISTANCE TO LETHAL AND NONLETHAL DAMAGE IN SACCHAROMYCES CEREVISIAE. Perper, T. (Rutgers-The State Univ., New Brunswick, NJ). Radiat. Res.; 63: No. 1, 97-118(Jul 1975).

Log-phase budding cells of two genetically marked diploid strains of S. cerevisiae are more resistant than nonbudding cells to x-ray-induced lethality and postirradiation lag, alterations in colony morphology associated with mitotic recombination, respiratory deficiency, and other nonlethal changes. The resistance of budding cells obtained from a nonbudding, small-cell population that had been stored in water at 6 to 8°C overnight was intermediate between that of nonbudding and log-phase budding cells. Post-irradiation shifts in growth medium elicited repair of lethal and nonlethal damage in nonbudding and sensitive budding cells. Repair of lethal damage was greater in sensitive budding cells, and repair of nonlethal damage greater in nonbudding cells. Effects of budding and the medium shift in reducing lethality in sensitive budding cells were additive, while effects of budding and the shift on nonlethal damage were nonadditive. Normal budding cell resistance to x-ray lethality seems, therefore, to resemble the process elicited by medium shifts, unlike resistance to nonlethal damage. Only induced repair of lethal damage was actinomycin D sensitive. These and other observations, as well as several published but previously uncollated reports, suggest that budding cell resistance to x-ray lethality depends in part on efficient repair of chromosome breaks, and is an adaptation for repairing damage in replicating DNA. (auth)

7537 DELAYED MATCH-TO-SAMPLE EARLY PERFORMANCE DECREMENT IN MONKEYS AFTER ^{60}Co IRRADIATION. Bruner, A.; Bogo, V.; Jones, R. K. (Lovelace Foundation, Albuquerque, NM). Radiat. Res.; 63: No. 1, 83-96(Jul 1975).

Sixteen monkeys were trained on a delayed match-to-sample task (DMTS) based on shock avoidance and irradiated with single, whole-body exposures of from 396 to 2000 rad ^{60}Co (midbody dose) at between 163 and 233 rad/min. Pre- to post-irradiation performance changes were assessed using a penalty-scaling measure which differentially weighted incorrect responses, response omissions, and error-omission sequences. Thirteen of the animals displayed early performance decrement, including five incapacitations, at lower doses (less than 1000 rad) than heretofore found effective. This was considered a function of task complexity, measurement sensitivity, and gamma effectiveness. The minimum effective midbody dose for inducing decrement using the DMTS task was estimated to be on the order of 500 rad. The nature of early, transient performance decrement seems to reflect more of an inability to perform than an inability to perform correctly. (auth)

7538 EARLY AND LATE CHANGES IN THE FUNCTIONAL VASCULARITY OF THE HAMSTER CHEEK POUCH AFTER LOCAL X IRRADIATION. Hopewell, J. W. (Churchill Hospital, Oxford). Radiat. Res.; 63: No. 1, 157-164(Jul 1975).

The effects of radiation on the functional vasculature of the hamster cheek pouch was evaluated by isotopic techniques. The ^{86}Rb extraction system was used to measure blood flow, while ^{51}Cr-labeled erythrocytes were utilized to determine changes in blood volume. Modifications in these two parameters were determined by comparisons between irradiated and control pouches in the same animal. As early as 2 wk after irradiation, the isotope techniques indicated increases in blood flow and volume for doses of 2000 and 3000 rads. At later times, modification in both flow and volume were indicated with doses of 500, 2000, and 3000 rads. No change was observed after a dose of 1000 rads. (auth)

7539 GENETIC EVALUATION OF THE COMBINED EFFECTS ON THE ORGANISM OF EXTERNAL IRRADIATION AND IRRADIATION FROM INCORPORATED ISOTOPES. Zapol'skaya, N. A.; Fedorova, A. V.; Tsygankova, Yu. L.; Yakovleva, N. G.; Lavent'ev, L. N.; Pavlitskaya, E. D.; Zhorno, L. Ya.; Mikhailov, V. G. pp 354-358 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The combined effects of an external single dose of x radiation at a dose of 300 R and the introduction of a mixture of ^{89}Sr and ^{144}Ce. The absorbed dose in the bone tissue and the gastrointestinal tract was evaluated. The results indicated that the external dose had the greatest effect on the different biological systems examined. If the individual doses of internal and external irradiation had an effect, then their combination had a unique summation effect. If the individual doses had no observable effect, then their combination gave no observable effect. (JSR)

7540 RESPONSE OF RAT LIVER NUCLEAR TRANSCRIPTION IN THE PRESENCE OF HEPARIN TO WHOLE-BODY GAMMA-IRRADIATION. Ferencz, A.; Hidvegi, E. J. (National Research Inst. for Radiobiology and Radiohygiene, Budapest). Stud. Biophys.; 50: 47-53(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

Heparin causes structural and functional changes in isolated rat liver nuclei. The main effects of heparin are disappearance of nuclear structure, inhibition of ribonuclease activity and increase of ribonucleic acid synthesis. At low salt ion concentration in the presence of Mg ions, heparin stimulates mainly enzyme B activity. 18 hours after whole-body irradiation the enzyme B activity, in the presence of heparin, slightly increased depending on the dose delivered. (auth)

7541 AUTORADIOGRAPHIC DETERMINATION OF DNA-REPAIR IN MOUSE LIVER AND KIDNEY USING AN IN VIVO METHOD. Hruby, R.; Reindl, E.; Kellner, G. (Forschungszentrum, Seibersdorf, Austria). Stud. Biophys.; 50: 83-87(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

DNA-repair has been investigated in liver and kidney of in vivo ^{60}Co-irradiated mice. In the liver DNA-repair mechanisms have been shown to exist as well in liver cells as in stellate cells. In the kidney in all cells of the cortex, but not in medulla DNA-repair occurs. (auth)

7542 EXPERIMENTAL EXAMINATION OF THE LATE EFFECT OF IONIZING RADIATION IN FOWL. Djukic, B.; Rusov, C. (Inst. of Pathology and Therapy-Faculty of Veterinary Medicine, Belgrade). Stud. Biophys.; 50: 65-72(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

Late effects of the ionizing radiation were examined with a special view to the reproductive ability and appearance of radiation leukosis. No cases of leukosis were observed in the White Rock and Leghorn breed chicks, which were irradiated on day 1, 6 and 12 with 500 R, during 17 month postradiation period. However, in some irradiated White Rock chicks total loss of reproductive ability was established. Aplasia of reproductive organs was recorded in 34% irradiated Leghorn chicks, while in 12% hypoplasia of oviduct and ovary took place. Only in 4% cases morphological and functional activity of genital organs was preserved. In an experiment on Leghorn chicks irradiated on day 1 and 6 with 400 R which were treated with methyl methanosulphonate /MMS/ in doses of 50 mg/kg lymphoid leukosis was established in 8% of all treated animals, i.e. in 22% of chicks that survived the acute toxic effect. In the groups of chicks that were either irradiated or MMS treated leukosis did not appear. In order to find out whether the agent of radiation and chemical leukosis was virus, cell-free material from diseased chick was inoculated to one day old chicks. After a latent period of 1.5 to 7.5 months in 33% of inoculated chicks lymphoid leukosis was developed. The results show that X-rays and MMS, as nonspecific leukosogenous factors, may act as a modifier for the physiological state of the target cell providing a favorable environment for multiplication of latent virus in chicks. (auth)

7543 BONE MARROW REGENERATION AFTER LOCAL INJURY: A REVIEW. Patt, H. M.; Maloney, M. A. (Univ. of California, San Francisco). Exp. Hematol.; 3: 135-148(1975).

This paper is focused on a mechanically depleted medullary cavity as an experimental model for analysis of marrow regenerative programs. The reconstitution of marrow in an evacuated cavity is basically a local phenomenon in respect to the stimulus for regeneration and the origin of the responsible cells. The nature of the triggering stimulus is unknown, but it is probably related to disruption of the continuity of the marrow stroma and endosteum. The initiating cells appear to be independent lines of mesenchymal and hematopoietic stem cells bound to bone, most likely within the endosteum and haversian system. The mesenchymal cells form the characteristic marrow stroma. Hemic cell regeneration can occur without immigrant hematopoietic stem cells, although such cells are known to contribute to later stages of repopulation. The formation and resorption of trabecular bone appears to be intimately related to the development of a sinusoidal matrix, perhaps by serving as a callus or supporting lattice and perhaps by providing a mechanism for distribution of stromal progenitors. Hematopoiesis is initiated in sites of active bone resorption. The interplay of events consequent to marrow removal is strikingly similar to that seen with heterotopic marrow implants. Because stromal stem cells, unlike hematopoietic stem cells, do not migrate from distant sites, marrow stroma is the limiting factor in recovery from localized injury. Stromal stem cells are fairly radiosensitive but are not as sensitive as hematopoietic stem cells. The apparent radioresistance of stromal elements in an intact marrow seems to

be due to their very low turnover rate. Latent radiation damage can be readily unmasked by conditions that promote their proliferation. This no doubt accounts for the radiosensitivity of stroma in an evacuated femur or heterotopic implant in contrast to its continued functional integrity with similar irradiation of in situ marrow. Even in an intact marrow, however, exposures in the 1000 rad range can lead to slowly evolving hypocellularity associated with diminished blood flow. With higher doses, aplasia of the irradiated site becomes progressively more generalized. It remains to be seen whether this limiting condition is due to the loss of specific regulatory functions of stromal components or merely reflects sinusoidal damage. (auth)

7544 STUDIES OF THE RADIOSENSITIZING ACTION IN VIVO OF 2,2,6,6, TETRAMETHYL-4-PIPERIDINOL-N-OXYL (TMPN). Hill, R. P.; Fielden, E. M.; Lillicrap, S. C.; Stanley, J. A. (Inst. of Cancer Research, Sutton, Eng.). Int. J. Radiat. Biol.; 27: No. 5, 499-501(May 1975).

TMPN (2,2,6,6, tetramethyl-4-piperidinol-N-oxyl) was tested for its in-vivo radiosensitizing properties on the B16 melanoma which is known to contain hypoxic cells when its host C57BL mouse is breathing air. Tumor-cell survival was the same whether or not the animals had been injected with TMPN, indicating no sensitization. It is further shown that there is a very rapid loss of the compound from the blood in vivo which is separate from the degradation in blood in vitro. (UK)

7545 SIALOPROTEIDS OF RAT LIVER AND BLOOD SERUM AFTER ACTION OF SMALL DOSES OF IONIZING RADIATION. Malashevich, E. V. (Inst. of Physiology, Minsk). Dokl. Akad. Nauk BSSR; 19: No. 7, 654-656(Jul 1975). (In Russian)

Data are presented on the effect of a 10-week chronic gamma irradiation, in a dose of 50 rad, on the perchloric-soluble protein content of blood serum and liver. The most characteristic changes were in the sialoproteid fractions. These changes were compared with changes in the ratio of sialic acid to the total blood and liver protein fraction. The absence of a correlation between the changes in the sialo acids in the perchloric extract and the serous mucoid fraction and the liver mucoprotein contents is related to the high heterogeneity of the latter. Apparently, determination of the sialoproteids in these compounds is of greater practical value than determination of their total content as related to the protein. (tr-auth)

7546 EMESIS IN MONKEYS FOLLOWING EXPOSURE TO IONIZING RADIATION. Middleton, G. R.; Young, R. W. (Armed Forces Radiobiology Research Inst., Bethesda, MD). Aviat., Space Environ. Med.; 46: 170-172(Feb 1975).

There were 129 male rhesus monkeys (Macaca mulatta) exposed to prompt radiations (neutron/gamma equals 0.4 and pulse width equals 50 ms) ranging from 700 to 5600 rad (midhead dose). The animals were fasted 18 h preexposure and observed for incidence of vomiting for 2 h postexposure. For doses less than 1000 rads, the number of animals that vomited increased directly with dose. Above 1000 rads, the number of animals that vomited decreased with increasing dose. The total number of vomits per dose group followed a nearly identical pattern to the incidence of emesis. In all dose groups, most of the emetic episodes occurred between 20 and 50 min postirradiation. (auth)

7547 EPIDERMAL UROCANIC ACID AND HISTIDASE OF ALBINO GUINEA PIG FOLLOWING TOTAL BODY UV-IRRADIATION. Wadia, A. S.; Sule, S. M.; Mathur, G. P. (Hindustan Lever Research Center, Bombay). Indian J. Exp. Biol.; 13: No. 3, 234-237(May 1975).

Urocanic acid (UCA), formed in situ by the action of epidermal histidase, is a physiological sunscreen present in the mammalian skin. Urocanase, the enzyme degrading UCA, is absent in the skin, and hence UCA accumulates in skin. UV-irradiation of albino guinea pig by erythemal doses (4 and 8 minimum erythemal dose, MED) results in reduction in epidermal UCA and histidase. UV-irradiation by suberythemal dose (0.4 MED) brings about maximal changes after 15 min of irradiation in epidermal histidase activity and UCA content. The epidermal UCA content increases with the increase in UV-dosage (0.4, 1.0, 2.0, 4.0 MED) showing an almost 100% increase at 2 MED dosage; however, further increase in the UV-dosage to 4 MED reduces the UCA content although the value is still higher than in control animals. The epidermal histidase activity decreases by about 40% at 0.4 MED dose, but with increase in UV-dosage, it increases and reaches the normal value at 2 MED. It is likely that UCA is embedded in the keratin mass of the skin or present in some bound form and not readily extractable except after UV-irradiation (suberythemal doses). It appears that the epidermal UCA content is regulated by the challenging UV-dosage, thus supporting the hypothesis of a physiological role of UCA in protecting the skin against the sunburn reaction. (auth)

7548 PROLIFERATIVE ACTIVITY OF SYNGENEIC MARROW TRANSPLANT IN IRRADIATED RECIPIENT. Mehra, N. K.; Vaidya, M. C.; Keswani, N. H.; Sharma, U. (India Inst. of Medical Sciences, New Delhi). Indian J. Exp. Biol.; 13: No. 3, 223-229 (May 1975).

Competence of the bone marrow cells to restore the hematological apparatus of lethally irradiated syngeneic recipients was studied in "A" strain mice. The control group, without bone marrow reconstitution after irradiation, exhibited complete aplasticity of the bone marrow, and total mortality. Syngeneic bone marrow transfusion, however, enhanced the survival rate of the recipients considerably. These animals, on examination of their marrow at different time intervals ranging from 6 to 68 days, showed predominance of small lymphocytes and small lymphocyte-like cells. The marrow architecture and the sinusoidal pattern returned to normal at about 52 days when erythrocytic, myelocytic and lymphoid series of cells were restored. The animals in the test group which were thymectomized prior to irradiation and subsequent bone marrow transfusion displayed better capacity for survival and appeared more healthy. The significance of this finding has been discussed. The results indicate that the marrow cell population after infusion into the irradiated recipients proliferates intensely and contributes to the reconstruction of bone marrow in the irradiated host, and that this function appears to be performed by the cytokinetically resting small lymphocyte-like cells in the bone marrow. (auth)

7549 INFLUENCE OF FRACTIONATED IRRADIATION WITH FAST ELECTRONS ON THE REPRODUCTION AND DNA SYNTHESIS IN CELLS OF MOUSE ASCITES LYMPHOMA. Moskalik, K. G.; Kozlov, A. P.; Akimov, A. A. (Scientific-Research Inst. of Oncology, Leningrad). Dokl. Biol. Sci.; 220: No. 1-6, 5-7(1975).

Translated from Dokl. Akad. Nauk SSSR; 220: No. 5, 1195-1198 (Feb 1975).

The intensity of cell reproduction and the ability of tumor cells to synthesize DNA after various sytems of fractionated irradiation were investigated in ascites lymphoma NK/Ly cells maintained by intraperitoneal transplantation into male mice of the SHR line. The fast electrons were administered over the period of one week at either 200 rads in 5 fractions, 333 rads in 3 fractions, or 500 rads in 2 fractions. All the systems of fractionation inhibited the reproduction of the tumor cells. A decrease in the number of fractions with a simultaneous increase in the individual dose led to a more pronounced inhibition of mitotic activity and DNA synthesis in the tumor cells. (ERB)

7550 THORACIC IRRADIATION-INDUCED LYMPHOPENIA IN MICE. Sutherland, J.; Maruyama, Y. (Univ. of Kentucky, Lexington). Oncology; 30: No. 1, 85-95(1974).

Thoracic or total-body x irradiation in the 2-month-old C57BL mouse produced a temporary and reversible lymphopenia as determined by peripheral blood counts. The duration was about 60 days. Delayed hypersensitivity to DNCB in all studied groups was similar for all groups during an observation period of 1 year. Irradiated animals showed a slight delay in healing a DNCB chemical burn. There was no difference in survival to a syngeneic tumor challenge of LSA lymphoma cells. (auth)

7551 LEUKAEMIC STEM CELL KINETICS IN EXPERIMENTAL ANIMALS. Tanaka, T. (Okayama Univ., Japan); Testa, N. E. G.; Lajtha, L. G. Bibl. Haematol.; 39: 984-991 (1973).

The normal pluripotential colony-forming haemopoietic stem-cell and its functional aspects have been investigated during development of a myelomonocytic leukaemia in mice. The kinetic changes in stem cell numbers and function are described and correlated with the leukaemic growth process. (auth)

7552 IONIZING RADIATIONS, GENETIC LOADS, AND POPULATION FITNESS: A REVIEW. Sankaranarayanan, K. (State Univ. of Leiden). Arch. Genet.; 46: No. 3, 137-139(1973).

Natural populations of all sexually reproducing outbred organisms carry large stores of genetic variants concealed in the heterozygous condition; most of these variants are detrimental or even lethal in homozygotes. Exposure of populations to radiation leads to an increment in the magnitude of these genetic loads. The dynamics of radiation-induced genetic loads especially their effects on population fitness has been extensively investigated in Drosophila, and to some extent in mammals. Most of the induced genetic variants are harmful to their carriers both in the homo- and in the heterozygous conditions and therefore are eliminated by natural selection. The results of studies with Drosophila suggest that, under certain conditions, some of the induced variants can improve fitness. The mammalian population experiments provide no unequivocal evidence to permit generalizations on whether induced mutations adversely affect fitness or not. Data on the genetic effects of radiation on aquatic ecosystems

are scanty. It is suggested that the use of radiations as a tool in fish breeding needs exploration. (auth)

7553 CHROMOSOME DAMAGE IN LIVER CELLS FROM LOW DOSE RATE ALPHA, BETA, AND GAMMA IRRADIATION: DERIVATION OF RBE. Brooks, A. L. (Inhalation Toxicology Research Inst., Albuquerque, NM). Science; 190: No. 4219, 1090-1092(12 Dec 1975).

Relative biological effectiveness (RBE) for chromosome damage in liver cells was determined after low dose rate exposures to alpha, beta, or gamma irradiation. Protracted exposures to beta and gamma irradiation were equally effective, whereas low dose rate exposures to alpha emitters were 15 to 20 times more damaging than exposures to beta or gamma irradiation. These data support the use of the quality factor of 10 recommended by the International Commission on Radiological Protection and the National Council on Radiation Protection for estimating the biological hazard from internally deposited alpha emitters. When the dose rates were low, all types of chromosome damage observed were produced by single-hit processes. (auth)

7554 FERTILITY AND IRRADIATION: A PRECONCEPTIONAL INVESTIGATION IN TERATOLOGY. Philippe, J. V. Am. J. Obstet. Gynecol.; 123: No. 7, 714-718(1 Dec 1975).

From 4th Pan-American Congress of Anatomy; Montreal, Quebec (17 Aug 1975).

The effects of preconceptional irradiation on female fertility were investigated in six groups of 35 nulliparous Swiss-Webster mice whole-body irradiated with single doses of 25, 50, 75, 100, 150, and 300 rads of ^{60}Co. They were mated with nontreated males and killed on gestational day 18. The litters were recorded in the chronologic order of their occurrence within each group. The percentage of pregnancies decreased with the dose, while the prenatal loss increased. Up to 100 rads, the middle group of pregnancies was devoid of resorptions, fetal death, and congenital anomalies, thus giving rise to a "maximum viability enclave." Beyond this level those three adverse effects were more or less homogeneously distributed over the whole period for which pregnancies were recorded. Exencephaly, microcephaly, and eye defects were the most frequent malformations. Among other sequelae, hypertrophy of the higher pole occurred in the left kidney in the surviving infertile females killed 5 months after treatment. (auth)

7555 RADIATION-INDUCED DNA SYNTHESIS IN NUCLEI OF HEN ERYTHROCYTES REACTIVATED IN HETEROKARYONS. Darzynkiewicz, Z. (Boston Biomedical Research Inst.). Exp. Cell Res.; 69: 477-481(Dec 1971).

The purpose of this study was to determine whether or not avian erythrocytes are able to repair their DNA and whether or not this ability is changed during nuclear reactivation in heterokaryons. (auth)

7556 RESTORATIVE EFFECT OF PERITONEAL MACROPHAGES ON DELAYED HYPERSENSITIVITY FOLLOWING IONIZING RADIATION. Volkman, A.; Collins, F. M. (Trudeau Inst., Saranac Lake, NY). Cell. Immunol.; 2: 552-566(Dec 1971).

Sublethal whole-body irradiation in the guinea pig had little demonstrable effect on the development of delayed hypersensitivity but caused a profound, though transient depression of dermal reactivity in previously sensitized animals. Macrophage-rich peritoneal cell suspensions from non-sensitive donors when injected intradermally with eliciting antigen, resulted in the restoration of a significant degree of reactivity following irradiation. Inocula of lymphocytes, on the other hand, failed to yield similar results. These findings, when taken with the persistence of low levels of reactivity following irradiation and the ability to transfer reactivity with peritoneal exudate cells from animals so treated, warrant the conclusion that the presence of macrophages is necessary for the expression of cutaneous delayed hypersensitivity. The spontaneously renewed activity which follows the depressed phase is thus more of a reflection of the recovery of macrophage precursors from radiation injury, rather than the emergence of a new population of sensitized cells. The results, in addition, substantiate the belief that the expression of delayed hypersensitivity requires at least two cell populations, only one of which carries the property of specificity at the outset. (auth)

7557 ULTRAVIOLET-INDUCED CUTANEOUS HYPEREMIA AND STEROID-INDUCED CUTANEOUS HYPOEMIA MEASURED BY ^{133}Xe DISAPPEARANCE IN DOGS. Chimoskey, J.E.; Flanagan, W. (Univ. of Washington, Seattle). J. Invest. Dermatol.; 63: No. 4, 362-366(1974).

^{133}Xe disappearance rates in dog skin were determined by injection of 100 mu c ^{133}Xe dissolved in 0.025 ml physiologic saline solution into the skin with a 30-gauge needle and external detection of gamma radiation with a 2-inch sodium iodide crystal, photomultiplier, rate meter, and timer-scaler system. Skin temperature was measured by a thermistor. Skin blood flow was manipulated by the topical application of fluocinolone acetonide and by ultraviolet radiation. Fluocinolone acetonide caused significant reduction of skin blood flow, and ultraviolet irradiation caused significant increase in skin blood flow. (auth)

Invertebrates

7558 (CENA-BC-015) MORTALITY AND REPRODUCTION OF SITOPHILUS ZEAMAIS MOTS. ON IRRADIATED RICE. Wiendl, F. M.; Arthur, V.; Sgrillo, R. B.; Domarco, P. E.; Tornisielo, V. L.; Pacheco, J. M.; Walder, J. M. M. (Sao Paulo Univ., Piracicaba (Brazil). Escola Superior de Agricultura Luiz de Queiroz). Mar 1974. 19p. (In Portuguese). INIS.

Corn weevils, Sitophilus zeamais Mots. were reared on irradiated rice. Diets were treated with dosages of 0, 20, 100, 500, and 1500 krad of gamma radiation. The parent generation was checked for mortality and fecundity. The analysis of results indicated an increase in longevity and progeny for the 20 krad dosage. A decrease in longevity and progeny was observed for other dosages. (INIS)

7559 (CONF-740379-) USE OF ISOTOPES IN PESTICIDES AND PEST CONTROL. Proceedings of a Symposium Held in Beirut, Lebanon, March 1974. Nehme, M.; Hassan, A. (eds.). (National Council for Scientific Research, Beirut (Lebanon); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt)). 1974. 267p. (In French and English).

From symposium on the use of isotopes in pesticides and pest control; Beirut, Lebanon (Mar 1974).

Separate abstracts were prepared for nine papers presented at the conference. An additional 16 papers were presented on various aspects of pest control. (HLW)

For abstracts of individual papers see: 7418, 7560–7566, and 7604.

7560 (CONF-740379-, 19-28) UTILIZATION OF RADIATION SOURCES IN THE FIGHT AGAINST THE PRINCIPAL INSECTS. Cheikh, M. 1974. (In French).

From symposium on the use of isotopes in pesticides and pest control; Beirut, Lebanon (Mar 1974).

In use of isotopes in pesticides and pest control. (National Council for Scientific Research, Beirut (Lebanon); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt)).

Social and economic aspects of insect invasions are reviewed with emphasis on damage to fruits, cereals, and other foods. Some topics discussed are: air pollution due to increased use of insecticides; biological control of insects using bacteria, rickettsiae, viruses, and fungi; use of radioisotopes for studies on pesticide residues, metabolism of insecticides by insects, and labeling of insects for studying their behavior, physiology, and ecology; use of radiation for disinfestation of grain supplies; and use of radiation for the sterile male technique. (HLW)

7561 (CONF-740379-, pp 125-130) INHERITED STERILITY IN PROGENY OF IRRADIATED MALE COTTON LEAF WORM, SPODOPTERA LITTORALIS BOISD. Wakid, A. F. M.; Hayo, J. M. (Atomic Energy Authority, Cairo). 1974.

From symposium on the use of isotopes in pesticides and pest control; Beirut, Lebanon (Mar 1974).

In use of isotopes in pesticides and pest control. (National Council for Scientific Research, Beirut (Lebanon); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt)).

When male Spodoptera littoralis was irradiated with 10, 20 and 30 krad (substerilizing doses) as full grown pupae, the produced adults (P_1) showed increasing sterility without affecting the adult longevity. When the F_1 adults (produced from irradiated males and normal female parents) were mated with the normal opposite sex, or when F_1 males and females were mated together, their fertility was found to be less than that of the parents. No significant effect on their longevity was found. However, sex ratio was altered in favour of males. (auth)

7562 (CONF-740379-, pp 131-136) BIOLOGICAL EFFECTS OF GAMMA RADIATION OF THE DEVELOPMENTAL STAGES OF SITOPHILUS ORYZAE L. Abdel-Malek, A. A.; Ahmed, S. H. (Cairo Univ., Giza, Egypt). 1974.

From symposium on the use of isotopes in pesticides and pest control; Beirut, Lebanon (Mar 1974).

In use of isotopes in pesticides and pest control. (National Council for Scientific Research, Beirut (Lebanon); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt)).

The effects of gamma radiation on the developmental stages of Sitophilus oryzae L. were studied. Doses from 5000-100,000 rad were applied to the different stages. No adults emerged from eggs, 1 and 2-week-old larvae at any treatment level. The emergence of adults from irradiated 3-week-old larvae occurred with doses as high as 30,000 rad. Adult emergence from irradiated pupae decreased as radiation dose increased and occurred with doses as high as 50,000 rad. A dosage of 100,000 rad caused 100% adults mortality within 6 days. Mortality at doses lower than 100,000 rad was greatly increased within 30 days and followed a pattern of increased mortality with increased dose. (auth)

7563 (CONF-740379-, pp 146-152) EFFECTS OF FRACTIONATION OF THE STERILIZING DOSE OF RADIATION ON EMERGENCE, FERTILITY, AND COMPETITIVITY OF THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA WIED. Mayas, I. (Institut de Recherches Agronomiques, Fanar, Lebanon). 1974. (In French)

From symposium on the use of isotopes in pesticides and pest control; Beirut, Lebanon (Mar 1974).

In use of isotopes in pesticides and pest control. (National Council for Scientific Research, Beirut (Lebanon); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt)).

The effect of fractionation of the sterilizing dose of γ rays (9 kr) on the pupae 3, 2 and 1 day(s) before emergence of C. capitata is studied. There is no significant difference in the mean of adult emergence between the group treated with continuous dose and that treated with fractionated dose. Males from pupae submitted to a fractionated treatment show a level of sterility which is not significantly different from that of males issued from pupae submitted to a continuous treatment. The competitiveness, tested in the laboratory, between irradiated and non-irradiated males, is expressed by the percentage of sterile eggs laid by nonirradiated females (ratio 3:1:1). Males from pupae receiving continuous treatment show a competitiveness significantly lower than that of males receiving fractionated treatment. This low level of competitiveness is maintained at least through 17 days after treatment. The various fractionation procedures of the sterilizing dose (3, 6 and 9 fractions) did not result in a significant difference in the sexual competitiveness nor in the mean of adult emergence. (auth)

7564 (CONF-740379-, pp 153-160) ANATOMICAL EFFECTS OF GAMMA IRRADIATION ON THE FEMALE REPRODUCTIVE ORGANS OF THE MEDITERRANEAN FRUIT FLY CERATITIS CAPITATA WIED. Shoukry, A.; Abdel-Malek, A. A.; Shehata, N. F. (National Research Centre, Cairo). 1974.

From symposium on the use of isotopes in pesticides and pest control; Beirut, Lebanon (Mar 1974).

In use of isotopes in pesticides and pest control. (National Council for Scientific Research, Beirut (Lebanon); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt)).

Pupae of the Mediterranean fruit fly, Ceratitis capitata Wied., 2 to 3 days before emergence, were irradiated with doses 1000, 2000, 3000, 4000, 6000 and 8000 R. At intervals of 1, 2, 4, 6 and 8 days after emergence, 10 females were collected, dissected and ovaries were mounted. Measurements of the maximum length and width of the ovaries were performed at those intervals. Results showed that at 1000 R, ovaries were more reduced in size than the corresponding controls especially on the 1st and 2nd days after emergence. The number of ovarioles ranges between 10 to 20 in comparison to 20 to 30 in the controls. At 2000 R, however, no ovarian growth was observed till the 6th day and the number of ovarioles was reduced to 1 to 3 ovarioles only. At both 3000 and 4000 R, ovaries showed no development till the 4th day and slight increase in ovarian size could be detected on the 6th and 8th day. A complete cessation of ovarian growth was noted at 6000 and 8000 R and the ovaries were about ⅓ and ¼ of their normal size on the 4th and 6th day respectively. (auth)

7565 (CONF-740379-, pp 161-174) STUDIES ON FACTORS INFLUENCING THE INDUCTION OF STERILITY IN ANOPHELES PHAROENSIS THOEBALD BY GAMMA RADIATION. Abdel-Malek, A. A.; Wakid, A. M.; Tantawy, A. O.; El-Gazzar, L. M. 1974.

From symposium on the use of isotopes in pesticides and pest control; Beirut, Lebanon (Mar 1974).

In use of isotopes in pesticides and pest control. (National Council for Scientific Research, Beirut (Lebanon); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt)).

The induction of sterility in Anopheles pharoensis mosquitoes by gamma irradiation is governed by many factors, three of which are studied in the present work. These are the development stage of the insect, the strain and the dose intensity. Eggs, first and fourth-instar larvae were found completely unsuitable for irradiation. On the other hand, irradiated pupae produced adults with highly reduced fecundity and fertility. When the pupae of the two strains received 8 Kr of gamma radiation, no significant difference was observed between them neither in the fecundity nor in the fertility of the produced adults. The effect of the dose-rate was tested on the pupal stage at the sterilizing dose level (8 Kr). The results indicated that the dose intensity affected neither the fecundity nor the fertility of the produced adults. (auth)

7566 (CONF-740379-, pp 233-242) EFFECT OF ULTRAVIOLET RADIATION AND TEMPERATURE ON PERSISTENCE, DEGRADATION, AND BIOACTIVITY OF PHOSVEL. Abdel-Wahab, A. M.; Tantawy, M. M.; Ali, A. M. (Assiut Univ., Egypt). 1974.

From symposium on the use of isotopes in pesticides and pest control; Beirut, Lebanon (Mar 1974).

In use of isotopes in pesticides and pest control. (National Council for Scientific Research, Beirut (Lebanon); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt)).

The exposure of Phosvel to short uv light on silicagel chromatoplates or in chloroform gives rise to a mixture of more than eight compounds. Among the compounds formed are: [O-(4-bromo-2, 5-dichlorophenyl) O-methylphenyl-phosphonate]; [O-(2,5-dichlorophenyl) O-methyl phenylphosphonothioate] and 4-bromo-2,5-dichlorophenol. The latter three identified degradation products also undergo photodecomposition forming 2,5 and 3 compounds, respectively. Phosvel exposed on glass surfaces at various temperatures ranging from 15° to 60°C. or to direct sunlight and in the dark volatilized readily. The half-life values were as follows: 16 hours and 17 days at 60° and 15°C., respectively, 64 hours and 16 days on exposure to sunlight and in the dark, respectively. Bioassay of uv-exposed Phosvel samples for various periods on cotton leafworm larvae, S. littoralis (Boisd), revealed that the toxicity was increased following irradiation then gradually decreased as the exposure period to uv light was prolonged. (auth)

7567 REGENERATION OF TRANSPLANTED INTACT CELL POPULATIONS IN LETHALLY IRRADIATED HYDRA. Noda, K.; Egami, N. (Tokyo Univ.). Radiat. Res.; 63: No. 1, 174-184 (Jul 1975).

A single irradiation of the hydra Pelmatohydra robusta with 0.4 to 10 kR of x rays induced no lethal effects at all, while animals exposed to 40 kR ceased to produce a bud within 24 hr and died within a limited period of time, varying from 10 to 14 days at 25°C, and from 28 to 50 days at 10°C. This lethal dose of x rays inhibited the proliferation of the cells completely and destroyed interstitial cells. When a small cell mass, which was too small to regenerate alone, was transplanted from the subhypostomal region of an intact animal into the subhypostomal region of the irradiated hydra, the recipient began to produce buds by the proliferation of the graft cells. However, the transplantation of intact peduncle tissue, in which mitotic figures and interstitial cells rarely occurred, failed to produce new buds. (auth)

7568 EFFECTS OF UV IRRADIATION OF NYMPHS OF BLATTELLA GERMANICA AND PERIPLANETA AMERICANA. Cohen, S. H.; Souss, J. A.; Roach, J. F.; Gingrich, J. B. (Army Natick Development Center, MA). J. Econ. Entomol.; 68: No. 5, 687-693(Oct 1975).

Certain effects of uv irradiation on nymphs of the American cockroach, Periplaneta americana (L.), and the German cockroach, Blattella germanica (L.), were investigated. Of 7 wavelengths to which the nymphs were exposed, 254 and 265 nm were the most effective in producing mortality. The approximate LD_{50} dose for nymphs exposed to germicidal (254 nm) uv was 4.56×10^4 mu j cm^{-2} for P. americana and 1.9×10^4 mu j cm^{-2} for B. germanica. UV irradiation resulted in retarded feeding and delay in weight gain and molting. Structural abnormalities were observed among adults of those nymphs which were exposed to either pulsed or continuous uv. Pulsed uv was more effective in producing mortality than continuous uv exposure. Nymphs lured to a specific area by food, water, food and water, contaminated filter paper, or filter paper containing a crude extract of aggregation pheromone were killed when irradiated with germicidal (254 nm) uv. (auth)

7569 GAMMA RADIATION FOR STERILIZATION IN VETERINARY SCIENCE. Arkhipov, V. V.; Lur'e, L. S.; Prokof'ev, N. S.; Khrushchev, V. G. pp 338-341 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A brief review is given of the use of γ radiation for the disinfection of infected animal products (hides, wool, fur, fibers, and

bristles) and in the preparation of biopreparations for veterinarian purposes. (JSR)

7570 DNA REPAIR AND DNA REPAIR INHIBITORS IN DROSOPHILA INVESTIGATIONS. Ivanova-Glavanakova, S.; Altmann, H.; Mukherjee, R. (Central Lab. of General Genetics, Sofia). Stud. Biophys.; 50: 117-121(1975).

From international conference on DNA repair and late effects; Budapest, Hungary (16 Sep 1974).

DNA repair inhibitors are of great importance in respect to induction of mutations. Another aspect of these chemical compounds is the cowering of a given radiation dose but resulting in the same effect on target cells. Up till now this combined treatment is only little used in cancer therapy. We proposed that also the sterile male technique is an area for this treatment. Some pesticides showed mutagenic properties and are DNA repair inhibitors. Therefore work on other methods for reducing a certain species of insects should be better emphasized. To obtain sterility of insects without a reduction in motility and viability repair inhibitors should be used which penetrate mainly to the germ cells. Some steroids are known as substances which can inhibit DNA repair processes. Beside motility tests, DNA repair inhibition was tested in salivary glands of late third-instar larvae of Drosophila melanogaster. Oestrogen, Cortison and also the detergent Tween 80 was used in these studies. The cells were preincubated with the repair inhibitors in the presence or absence of hydroxyurea. The damage of DNA was done by 30 krad Co-60-irradiation. The H^3-Thymidine incorporation in DNA was a measure for semi-conservative DNA synthesis or DNA repair respectively. Oestrogen, Cortisone and Tween 80 showed a strong reduction of Thymidine incorporation in the presence of hydroxyurea in the DNA of the salivary gland cells after gamma irradiation. (auth)

7571 CODLING MOTH: CATCHES OF IRRADIATED AND UNTREATED LABORATORY-REARED AND NATIVE MALES IN SYNTHETIC SEX ATTRACTANT TRAPS. White, L. D.; Hutt, R. B. (Yakima Agricultural Research Lab., WA). J. Econ. Entomol.; 68: No. 4, 449-450(15 Aug 1975).

Irradiated native males of Laspeyresia pomonella (L.) treated with 30 krad of gamma irradiation were less responsive (20 and 44 percent were caught) to traps baited with the synthetic sex attractant than irradiated laboratory-reared males (32 and 62 percent). Unirradiated native males showed the best response to traps (70 percent). Fewer irradiated laboratory-reared males were captured when they were released with irradiated laboratory-reared females than when they were released alone. (auth)

7572 IRRADIATED BOLL WEEVILS: PHEROMONE PRODUCTION DETERMINED BY GLC ANALYSIS. McGovern, W. L.; McKibben, G. H.; Gueldner, R. C.; Cross, W. H. (Boll Weevil Research Lab., Mississippi State, MS). J. Econ. Entomol.; 68: No. 4, 521-523(15 Aug 1975).

The production of pheromone by Anthonomus grandis Boheman when treated with 10,000 rad of ^{60}Co gamma irradiation compared favorably with that of control weevils for 5 days; however, feeding (determined by frass collection) was reduced from day one. No direct correlation was found between production of pheromone and elimination of frass. (auth)

7573 IMMUNITY TO FASCIOLA HEPATICA IN THE RAT. Armour, J.; Dargie, J. D. (Univ. of Glasgow Veterinary School). Exp. Parasitol.; 35: 381-388(Jun 1974).

Experiments were carried out which demonstrated an acquired immunity to Fasciola hapatica in the rat. It was shown that this immunity could be transferred to recipients using either lymphoid cells or serum from infected donor rats. The extent of the protection obtained by cells appeared to be related to the quantity and persistence of the antigenic stimulus in the donor. Likewise, the degree of immunity conferred by immune serum was dependent upon the volume transferred. The significance of these results in relation to the mechanism of immunity to fascioliasis is discussed. (auth)

7574 CODLING MOTH CONTROL BY RELEASE OF RADIATION-STERILIZED MOTHS IN A POME FRUIT ORCHARD AND OBSERVATIONS OF OTHER PESTS. Proverbs, M. D.; Newton, J. R.; Logan, D. M.; Brinton, F. E. (Agriculture Canada, Summerland, B. C.). J. Econ. Entomol.; 68: No. 4, 555-560(15 Aug 1975).

Release of radiation-sterilized male and female Laspeyresia pomonella (L.) in a 40-ha pome fruit orchard from 1969-72 in the Similkameen Valley of British Columbia reduced the wild population of this pest to a very low level without causing serious problems in control of other apple and pear pests. Percent apples injured by codling moth larvae at harvest were 0.1 in 1968 (after 3 sprays of azinphosmethyl), and 0.05, 0.02, 0.007, and 0.001 from 1969-72. (auth)

7575 IRRADIATION OF MATURE DROSOPHILA-SPERMS: DEPENDENCE OF THE RATES OF MUTATION ON THE GENOTYPE AND AGE OF THE TESTED FEMALE. Maier, P. (Eidgenoessische Technische Hochschule, Zurich). Arch. Genet.; 46: No. 3, 173-195(1973). (In German)

Drosophila males carrying a ring-X-chromosome were x-rayed. The treated males were crossed to 1 and 4 day old females of two different stocks (Oster, y sn). The rates of recovered dominant lethals, sex-chromosome losses and translocations depend on genotype and age of the test females. These maternal effects are interpreted as follows: The time course of the replication process of the paternal chromosome set after insemination is different in the two stocks. Therefore different amounts of radiation-induced lesions on paternal chromosomes are repaired before cleavage. In addition, in eggs of Oster females the condensation of the paternal chromosomes at the beginning of cleavage starts earlier than in eggs of y sn females. This leads to different frequencies of premature condensated ring-X-chromosomes and results in different rates of lethality and chromosome loss. This phenomenon also depends on the age of the test females. (auth)

Radionuclide Effects (Internal Source)

Man

Refer also to abstracts 7474, 7496, and 7666.

7576 (BNWL-SA-5550) MICRODOSIMETRY OF INTERNAL, PARTICULATE SOURCES. Roesch, W. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 8 Sep 1975. Contract E(45-1)-1830. 17p. (CONF-751043-5). Dep. NTIS $4.50.

From workshop on the biological effects and toxicity of Pu 239 and Ra 226; Sun Valley, Idaho, USA (6 Oct 1975).

The theory of microdosimetry is extended to include particulate and non-uniformly distributed sources typical of internally deposited radioisotopes. An example is presented in which stationary particulates of ^{239}Pu of negligible physical size are distributed at random in a tissue in which the sensitive sites are also assumed to be randomly distributed. Preliminary calculations are reported for this model of the probability density in specific energy of all the sites and of the fraction of sites in which no energy is deposited for particulates that emit between 1 and 100,000 alpha particles. (auth)

7577 (BNWL-SA-5588) CALCULATED DOSES FROM INHALED TRANSURANIUM RADIONUCLIDES AND POTENTIAL RISK EQUIVALENCE TO WHOLE-BODY RADIATION. Strom, P. O.; Watson, E. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. 34p. (CONF-751105-16; SM-199/114). Dep. NTIS $5.00.

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, California, USA (17 Nov 1975).

The distribution of radiation dose commitments within the body that can result from the lung deposition of a number of transuranic radionuclides (^{237}Pu, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, ^{242}Pu, ^{243}Pu, ^{244}Pu, ^{241}Am, ^{242}Am, ^{243}Am, ^{244}Am, ^{242}Cm, ^{243}Cm, ^{244}Cm, and ^{246}Cm) was calculated. The variables that influence these organ dose commitments include the mobility of the particle or its dissolution products within the body, the radiation characteristics of the inhaled radionuclides and their progeny, and the size of the particles inhaled. In the calculation of organ dose commitments for whole-body, lungs, liver, bone tissues, kidneys and gastrointestinal tract from the inhalation of transuranium radionuclides, physical characteristics of importance are the dimensions of the particle, its aerodynamic properties, and its density. For particles within the respirable size range, a useful description is provided by the activity median aerodynamic diameter. Dose commitments resulting from acute inhalation of plutonium, americium, and curium nuclides relative to the activity median aerodynamic diameter (AMAD) were calculated using the computer program DACRIN. Deposition efficiencies were estimated for several regions of the respiratory tract as a function of the AMAD. These locations within the respiratory tract are described as the nasopharyngeal, the tracheobronchial, and the pulmonary regions. The deposition, migration, and retention of particles introduced into the respiratory tract are represented by descriptive mathematical models of these phenomena within the respiratory system. Estimates of the risk of excess deaths from cancer due to whole-body radiation doses are included in the calculations to provide an estimate of cancer death risks associated with the inhalation of transuranic compounds. These results are then equated to those from whole-body radiation doses. (CH)

7578 (CONF-751105-17) CURRENT STATUS OF THE PLUTONIUM HOT PARTICLE PROBLEM. Richmond, C. R. (Oak Ridge National Lab., Tenn. (USA)). 1975. 12p. Dep. NTIS $4.50.

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, California, USA (17 Nov 1975).

Information now available on the question of lung irradiation from particulate plutonium is reviewed. Careful consideration of the available data shows that particulate plutonium is not more hazardous than the same amount of plutonium distributed uniformly. The data also suggest that the potential hazard from plutonium increases as the dispersion throughout the lung becomes more uniform. (CH)

7579 CHRONIC RADIUM INTOXICATION: CLINICAL AND AUTOPSY FINDINGS IN LONG-TERM NEW JERSEY SURVIVORS. Sharpe, W. D. (Cabrini Health Care Center, New York). Environ. Res., 8: No. 5, 243-283(Dec 1974).

Several cases of chronic radium intoxication are presented. The cases include clinical, radiological, and autopsy findings. All of the cases are characterized as long-term survivors. Case material is derived from New Jersey medical records. (ERB)

7580 PRESENT STATUS OF CLINICAL DOSIMETRY DURING USE OF RADIOACTIVE ISOTOPES IN RADIOTHERAPY. Kronzauz, A. N. pp 138-143 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The principal problems connected with clinical dosimetry at the present time are briefly considered. These include measurement of the absorbed dose, types of detection instruments used, spatial distribution of exposure and absorbed dose, and the use of computers for data acquisition and evaluation. (JSR)

7581 FORMATION OF THE DOSE FIELD OF ONCOLOGICAL NEEDLES AND APPLICATORS WITH ^{137}Cs AS A FUNCTION OF THE MATERIAL AND THICKNESS OF THE FILTER. Bochkarev, V. V.; Ivanov, Yu. F.; Timofeev, L. V.; Zav'yalova, V. I.; Obvintsev, G. V. pp 148-155 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The spectral distribution of electrons around ^{137}Cs needles and applicators with filters of steel and platinum of different thicknesses were measured. The results, shown graphically, were used to calculate the absolute value of the dose rate and the character of its distribution according to the tissue depth. (JSR)

7582 EVALUATION OF THE RADIATION CONDITIONS DURING WORK WITH RADIOACTIVE MATERIALS. Alferov, M. V.; Bad'in, V. I.; Batova, Z. G.; Parkhomenko, G. M.; Sayapina, R. Ya.; Sayapin, N. P.; Surovezhin, N. N. pp 210-214 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A study was made of the laws of the distribution of the size of the individual uptake and accumulation of radioactive material and of the individual dose of persons working with radioactive materials. It was determined that the distribution of the uptake and accumulation follow a log-normal law. An evaluation of the radiation conditions must be made on the basis of safety criteria limiting the probability of the appearance of a radiation burden to critical organs. (JSR)

7583 RADIATION SAFETY DURING PREPARATION OF TRITIUM-LABELLED ORGANIC COMPOUNDS. Parkhomenko, G. M.; Batova, Z. G. pp 224-227 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

In order to evaluate the radiation safety during preparation of tritium-labelled compounds, the contents of T_2O was measured in the air of the work area, on the surface of equipment and construction materials, and on the hands of workers. The means for the accumulation of tritium in people and its elimination with biosubstrates was also studied. The results obtained on the air contents and the contents in the urine are tabulated. Tritium accumulation occurs through respiration and by absorption through the skin of the hands. The Wilzbach isotopic exchange method appears to be the safest method for tritium labelling. (JSR)

7584 HYGIENE ASPECTS CONNECTED WITH THE CONTAMINATION AND DECONTAMINATION OF INTEGUMENTS FROM RADIOACTIVE CONTAMINATION. Parkhomenko, G. M.; Khodyreva, M. A.; Vorob'ev, A. M. pp 227-233 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The principles for the selection of and the composition of washing agents for contaminated skin areas were developed and specific formulations of de-activating preparations were proposed for decontamination of the skin from various radioactive isotopes. The early treatment with these recommended preparations almost completely decontaminates skin and therefore eliminates the possibility of skin irradiation and introduction of the isotope into the body. (tr-auth)

7585 USE OF OPEN RADIOACTIVE ISOTOPES FOR RADIATION OF MALIGNANT NEOPLASMS. Aleksandrov, N. N.; Sukovatykh, L. S. pp 254-257 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The results obtained on the use of implanted colloidal ^{198}Au either before or after radical surgery for malignant neoplasms at various sites of the body at the Scientific Research Institute of Oncology and Medical Radiology in Belorussia are briefly reported. (JSR)

7586 INTRALYMPHOVASCULAR INTRODUCTION OF ^{131}I-IODOLIPOL FOR X-RAY DIAGNOSIS AND RADIOTHERAPY OF MALIGNANT DISEASES OF THE LYMPHATIC NODES. Ryzhikh, A. N.; Fain, S. N.; Sedov, V. V.; Millerman, A. Sh. pp 257-261 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The use of ^{131}I-iodolipol for an x-ray contrast medium and the simultaneous irradiation of the lymph nodes for therapeutic purposes was studied. The studies showed that the substance is preferentially fixed in the lymph nodes. The results showed that it is suitable for use as a contrast medium and does not increase the complications and post-operative mortality in cancer of the rectum. Analysis of patients receiving the drug showed a tendency for prolongation of life in patients with metastases in the lymph nodes. (JSR)

7587 RADIOACTIVE COLLOIDAL GOLD IN THE THERAPY OF MALIGNANT TUMORS AT INDIVIDUAL LOCATIONS. Volkova, M. A.; Lel'man, S. G.; Kuznetsova, I. P.; Borisov, E. A.; Ashikhmina, I. G.; Degtyarenko, V. V. pp 261-263 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Experimental studies of the effectiveness of colloidal ^{198}Au showed that its intralymphovascular introduction in combination with telegamma therapy can replace surgery for malignant diseases of the arms and legs, penis, and external female sex organs. (JSR)

7588 CALCULATION OF ISODOSE CURVES ON A COMPUTER DURING USE OF SEALED RADIOACTIVE SOURCES IN GYNECOLOGY. D'yachenko, M. N.; Radin, A. M.; Dun, D. L.; Khodos, L. S. pp 297-300 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Computer calculations were made of the dose field for different cross sections of the pelvis during treatment of cancers of the cervix uteri and corpus uteri. The computational method is described and typical isodose curves are given. (JSR)

7589 PRELIMINARY DATA ON THE CALIBRATION OF PLUTONIUM DURING ACCIDENTAL AEROGENIC UPTAKE. Malykhin, V. M.; Shamov, V. P.; Isanin, N. A.; Bogdanova, L. A. pp 349-353 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The effect of the physical-chemical state of the Pu and the degree of its dispersion during aerosol inhalation on its retention and elimination by the respiratory system were studied. The irradiation dose in rems was determined as a function of the median aerodynamic diameter and its chemical form as the nitrate or the dioxide. The results obtained are tabulated. (JSR)

7590 DOSIMETRY OF FOUR HEART-IMAGING RADIONUCLIDES: ^{43}K, ^{81}Rb, ^{129}Cs, AND ^{201}Tl. Feller, P. A.; Sodd,

V. J. (Cincinnati General Hospital). J. Nucl. Med.; 16: No. 11, 1070-1075(Nov 1975).

In conjunction with research into the relative clinical suitability of radionuclides for heart imaging, estimates of the radiation dose from ^{43}K, ^{81}Rb, ^{129}Cs, and ^{201}Tl were calculated. Estimates of absorbed radiation dose for the heart, kidneys, liver, lungs, testes, and whole body of the standard man were computed from published distribution data in rats via the MIRD method by assuming that the concentration in each organ per initial mean whole-body concentration is the same in rats and humans. The whole-body absorbed radiation doses from ^{81}Rb, ^{129}Cs, ^{201}Tl, and ^{43}K are 0.08, 0.17, 0.24, and 0.60 rads/mCi administered intravenously. In general, the organ doses for the four radionuclides follow the same order. (auth)

7591 SUMMARY OF CURRENT RADIATION DOSE ESTIMATES TO HUMANS FROM ^{123}I, ^{124}I, ^{126}I, ^{130}I, AND ^{131}I AS SODIUM ROSE BENGAL. J. Nucl. Med.; 16: No. 12, 1214-1217(Dec 1975).

Estimated absorbed doses to human gall bladder, gastrointestinal tract, liver, ovaries, bone marrow, and testes from ^{123}I, ^{124}I, ^{126}I, ^{130}I, and ^{131}I after a single intravenous administration as sodium rose bengal are summarized. The greatest uncertainty in these dose estimates is due to the variability in time for the movement of radioiodine through the biliary tract, gall bladder, and gastrointestinal tract. (ERB)

Animals

Refer also to abstracts 7517 and 7539.

7592 (BNL-20599) GENETIC AND HEMATOPOIETIC EFFECTS OF LONG-TERM TRITIATED WATER (HTO) INGESTION IN MICE. Carsten, A. L.; Cronkite, E. P. (Brookhaven National Lab., Upton, N.Y. (USA)). 1975. 12p. (CONF-751126-7; SM-202/303). Dep. NTIS $4.50.

From IAEA international symposium on biological effects of low level radiation pertinent to protection of man and his environment; Chicago, Illinois, USA (3 Nov 1975).

The positive effects seen using the somewhat insensitive dominant lethal test system and the effects seen on the blood-forming cells indicates that at least in the mouse there is a hazard in the continuous ingestion of HTO at a concentration of 3 mu Ci/ml. A direct comparison of these results to the human drinking an equivalent amount of HTO is impossible due to the obvious differences in water metabolism between the two species. Until further experimentation at lower levels of ingestion are completed, it is difficult to comment concerning the significance of these results as related to current concepts of maximum permissible concentration. Studies are now underway examining the possible effects of lower concentrations of chronic HTO ingestion. (auth)

7593 (CONF-751126-6) RESPONSE OF THE MOUSE FETUS TO RADIATION FROM Na/sup 99m/TcO_4. Lathrop, K. A.; Gloria, I. V.; Harper, P. V. (Franklin McLean Memorial Research Inst., Chicago, Ill. (USA)). 1975. Contract E(11-1)-69. 16p. (SM-202/416). Dep. NTIS $4.50.

From IAEA international symposium on biological symposium on biological effects of low level radiation pertinent to protection of man and his environment; Chicago, Illinois, USA (3 Nov 1975).

The element technetium has recently assumed ecological importance as a source of low-level radiation, with the use of /sup 99m/Tc in nuclear medicine and production of /sup 99m/Tc during generation of electricity by nuclear reaction. When technetium is introduced as pertechnetate into the blood stream of pregnant females, it is transported across the placental barrier to the fetus, where a portion appears to be incorporated into biomolecules. When combined as biomolecules, radionuclides that decay by electron capture or isomeric transition show a lethality greater than that predicted in cell cultures and radiation therapy. The decay of /sup 99m/Tc by isomeric transition, together with the other above-mentioned considerations, places a high priority on the investigation of its radiation effects due to clinical doses of up to 25 mCi. Female mice were given daily i.v. injections of 0, 5, 50, and 500 mu Ci of /sup 99m/Tc as pertechnetate in isotonic saline throughout gestation, gestation and lactation, or lactation. At two months of age, the progeny were mated with randomly selected litter mates to produce a second generation; the process was repeated with their progeny for production of the third generation. Only the first generation was irradiated. An injection of 5 mu Ci/mouse and 10 mCi/human both approximately equal 0.2 mu Ci/g of body weight; however, the mouse fetus receives an estimated radiation dose of 0.05 rad, and the human 1 rad. Throughout the gestation period, a mouse at the 5 mu Ci level receives about 100 mu Ci of /sup 99m/Tc, resulting in approximately 1 rad to the fetus. Significant reduction of body weight was noted in all experimental groups compared with weights of control animals. The greatest effects were seen in the progeny of mothers treated during gestation only. A tendency toward recovery seen in the third generation may possibly be explained by elimination of some animals from the genetic pool. These preliminary results reinforce the existing concern about use of /sup 99m/Tc-pertechnetate in pregnant or potentially pregnant subjects. (auth)

7594 (LA-UR-75-1905) BIOLOGICAL EFFECT OF FOCAL ALPHA RADIATION ON THE HAMSTER LUNG. Smith, D. M.; Anderson, E. C.; Prine, J. R.; Holland, L. M.; Richmond, C. R. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1975. 12p. (CONF-751126-2). Dep. NTIS $4.50.

From IAEA international symposium on biological effects of low level radiation pertinent to protection of man and his environment; Chicago, Illinois, USA (3 Nov 1975).

Monodispersed 10-mu m diameter ZrO_2 ceramic microspheres, containing varying amounts of $^{239}PuO_2$ or $^{238}PuO_2$, were injected into the jugular vein of 100-day-old Syrian hamsters. These biologically inert microspheres lodged subsequently in pulmonary capillaries and remained static in position throughout the life span of the animals with no discernible inflammatory response. The numbers of microspheres injected ranged from 2000 to 10,000 and the specific activity from 0 to 59 pCi/sphere so that the lung burdens were 0 to 354 nCi/animal. At these numbers, each plutonium-laden microsphere served as an independent, focal source of alpha radiation. No consistent alteration of life spans post-exposure was seen in the experimental hamsters compared to controls. Pulmonary tissue responses were minimal with only 0.5 percent of the animals given Pu/ZrO_2 microspheres ultimately developing primary tumors of the lung. No unexpected gross or histologic lesion were found in other major body tissues. (auth)

7595 EXPERIMENTAL EVALUATION AND MEANS OF EVALUATING POSSIBLE CLINICAL APPLICATIONS OF COLLOIDAL SOLUTIONS WITH RADIOACTIVE YTTRIUM ^{90}Y. Seryi, S. V.; Mikheev, N. B.; Gracheva, M. A.; Lopatnikova, Z. F.; Parfenova, E. G.; Zaretskii, I. I.; Reshchikov, V. P.; Khanykova, O. K.; Shkarenkov, A. A. pp 263-266 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The therapeutic and toxic effects of highly dispersed and coarsely dispersed colloidal solutions of yttrium sulfate and the accumulation of the radioisotope in various organs was studied in experiments on mice, rats, and rabbits with tumors. The experimental results showed that the coarsely dispersed colloidal solutions injected in the tumorous areas showed a smaller degree of redistribution in the animal than the finely dispersed colloidal solution. Intravenous injections can be used in hematological practice, but intraperitoneal injection results in significant accumulation of the radioisotope in the liver and bone tissue. (JSR)

Nuclide Kinetics and Toxicology

7596 BIOLOGICAL EFFECTS OF DEUTERIUM AND OTHER STABLE ISOTOPES. Lacroix, M.; Mosora, F. (Univ. Liege, Sart Tilman, Belgium). pp 383-387 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Numerous review articles have already been published on the biological effects of deuterium. The most important of these effects are briefly recalled with special emphasis on the consequences of deuteriation on living organisms. The toxicity of low doses of deuterium is examined, particularly in the light of a hypothesis associating deuterium with ageing processes. The natural variations of deuterium concentration are considered in this connection. The use of the isotopic properties for modifying the pharmacological efficiency of various substances is also examined. In conclusion, the authors discuss the effects of two other stable isotopes, carbon-13 and oxygen-18. (auth)

7597 INFLUENCE OF WATER-SOLUBLE DECOMPOSITION PRODUCTS OF GRASSY PLANTS ON THE ABSORPTION OF RADIOISOTOPES IN THE SOIL. Chebotina, M. Ya.; Kulikov, N. V. (Inst. of Plant and Animal Ecology, Sverdlovsk, USSR). Sov. J. Ecol. (Engl. Transl.); 4: No. 1, 84-85(1973).

Translated from Ekologiya; 4: No. 1, 102-103(1973).

Solutions of chloride compounds of ^{90}Sr, ^{91}Y, ^{137}Cs, ^{144}Ce, and ^{60}Co were introduced into aqueous extracts of various plants. The solutions were placed in test tubes with samples of dried soil and shaken on an electric mixer. Distilled water was used instead of plant extracts in controls. The tabulated results show that in the presence of plant extracts the distribution coefficients of all radioisotopes were sharply reduced in comparison with controls. (HLW)

7598 ESTIMATION OF THE ERRORS IN DETERMINING THE UPTAKE OF RADIOACTIVE ISOTOPES IN THE RESPIRATORY ORGANS. Lekhtmakher, S. O.; Ruzer, L. S. Meas. Tech. (USSR) (Engl. Transl.); 18: No. 5, 758-760(May 1975).

Translated from Izmer. Tekh.; 18: No. 5, 75-76(May 1975).

Errors in determining the uptake of radioisotopes in the respiratory organs are estimated mathematically. (ERB)

Man

Refer also to abstracts 7304, 7642, 7676, and 7699.

7599 (BNWL-SA-5388) PREDICTION OF THE HEALTH EFFECTS OF INHALED TRANSURANIUM ELEMENTS FROM EXPERIMENTAL ANIMAL DATA. Bair, W. J.; Thomas, J. M. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 22p. (CONF-751105-14). Dep. NTIS $4.50.

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, California, USA (17 Nov 1975).

The purpose of animal experiments with transuranium elements is to provide information which can be used to predict the consequences of these alpha emitting elements for human health. However, scientific and technical groups have been hesitant to project from animal experiments to man. Since a human data base does not exist for inhaled plutonium it is necessary to extrapolate from animal experiments. In this report knowledge of the behavior of inhaled transuranium elements is reviewed with respect to clearance from lungs and spatial distribution within lungs. The current status of the relationship between lung cancer incidence and alpha radiation dose from inhaled transuranics is described. An estimate of risk obtained from the animal data is compared with a value derived from human data on radiation induced lung cancer and both are compared with the estimated cancer risk associated with the annual whole body dose limit of 5 rems for occupational exposure. The conclusion is that 15 rems per year to the lungs from transuranium elements is not a greater risk than 5 rem/year whole body exposure and may be less. (auth)

7600 (LA-UR-75-1887) CONSIDERATIONS IN THE ASSESSMENT OF PLUTONIUM DEPOSITION IN MAN. Voelz, G.; Umbarger, J.; McInroy, J.; Healy, J. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-ENG-36. 19p. (CONF-751205-4). Dep. NTIS $4.50.

From IAEA international seminar on diagnosis and treatment of incorporated radionuclides; Vienna, Austria (8 Dec 1975).

Data from human cases of plutonium inhalation are used to illustrate several important problems in the current methods of estimating plutonium body burdens. Individuals exposed to $^{238}PuO_2$ particles in a highly insoluble matrix showed an unusually slow rising urinary excretion curve over 300 to 400 days. In vivo chest counts during the first 6 months estimated lung burdens to be 10 to 30 nCi, but urinary excretion methods calculate residual systematic body burdens of 50 to 100 nCi at 1200 days after exposure. Current assumptions used in the in vivo calibration do not consider possible lung distribution of particulates soon after exposure that could alter the interpretation significantly. Tissue analysis of a lung from another case after recent inhalation exposure shows a significantly lesser concentration of plutonium in the subpleural region–the principal region of plutonium measurement by in vivo chest counting–as compared to distributions found years after exposure. Tissue analyses indicate that urinary excretion estimates of body burden over the long term tend to err on the high side up to a factor of 5 or more. This procedure serves well for the purpose of protection of workers, but high estimates can lead to unnecessary job reassignments for the individual worker and can cause misleading conclusions when such data is used uncritically for reference in health effects studies. Additional research is needed to improve urinary excretion data analysis to reflect newer information derived from tissue data and to seek further understanding of the sources of variation in in vivo counting technology so it can be used with greater confidence. (auth)

7601 IRON-INDUCED ENHANCEMENT OF ^{67}Ga UPTAKE IN A MODEL HUMAN LEUKOCYTE CULTURE SYSTEM. Hill, J. H.; Merz, T.; Wagner, H. N. Jr. (John Hopkins Medical Institutions, Baltimore). J. Nucl. Med.; 16: No. 12, 1183-1186(Dec 1975).

The addition of iron, either as Fe dextran or $FeCl_3$, to leukocyte tissue culture medium (containing 20 percent fetal calf serum) significantly increased the cellular accumulation of subsequently added ^{67}Ga-citrate. This effect of iron was dose-related and decreased, after the initial increase, with increasing concentrations of elemental iron. There was a significant negative correlation (P less than 0.025) between the concentrations of gallium and iron in the medium, indicating competition between the two elements for the same serum binding sites. Although it is not yet justified to begin clinical trials, these experiments suggest the possibility that prior administration of iron may increase the usefulness of ^{67}Ga scanning for the diagnosis of neoplasms or abscesses. Further testing of this hypothesis in animals with such lesions would seem indicated. (auth)

7602 USE OF A FOUR-CRYSTAL γ SPECTROMETER IN THE LOW-BACKGROUND CHAMBER FOR STUDY OF THE ASSIMILATION OF ^{58}Co-LABELLED VITAMIN B_{12} AND ^{59}Fe IN PATIENTS WITH CANCER OF THE STOMACH. Kaplan, M. A.; Gabuniya, R. I.; Androsov, N. S. pp 82-86 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The absorption of ^{58}Co-B_{12} and ^{59}Fe in the presence of stomach cancers depends on the stage and location of the cancerous process; the assimilation of B_{12} is significantly reduced with cancers of the proximal section of the stomach and ^{59}Fe with cancers of the distal section. In patients with metastases in the liver an increased assimilation of B_{12} and very sharp reduction of Fe assimilation was determined. The dependence between the degree of development of anemia and the indicators of the assimilation of B_{12} was established. Absorption of the vitamin decreased during progression of the anemia. Differences in the assimilation of ^{59}Fe at different stages of anemia and with different quantities of serum Fe were not established. (tr-auth)

Animals

Refer also to abstracts 7280, 7303, 7557, 7595, and 7677.

7603 (BNWL-SA-5456) ASPECTS OF INHALED DTPA TOXICITY IN THE RAT, HAMSTER AND BEAGLE DOG AND TREATMENT EFFECTIVENESS FOR EXCORPORATION OF Pu FROM THE RAT. Smith, V. H.; Ballou, J. E.; Lund, J. E.; Dagle, G. E.; Ragan, H. A.; Busch, R. H.; Hackett, P. L.; Willard, D. W. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 16p. (CONF-751205-6; SM-6/26). Dep. NTIS $4.50.

From IAEA international seminar on diagnosis and treatment of incorporated radionuclides; Vienna, Austria (8 Dec 1975).

After inhaling 1 to 4 HD (human dose equivalents, i.e., 1 g calcium trisodium N,N-bis (2-bis(carboxymethyl)amino) ethyl) glycinate/70 kg body weight) of Ca-DTPA rats and hamsters developed a transitory vesicular emphysema. This was not found in animals sacrificed later than 3 weeks after the last exposure. Dogs were anesthetised and administered Ca-DTPA aerosols via an intratracheal catheter for 30 min/day for 5 days. The average dose/exposure was 4 HD. One week following the last exposure, 3/4 treated dogs and 0/2 dogs exposed to saline aerosols showed enlargement and submucosal lymphoid follicles in the pyloric region of the stomach; this was not present in dogs sacrificed at 4, 8 or 18 weeks postexposure. Epithelial atypia in the alveolar lining was noted in 5/16 dogs inhaling Ca-DTPA and in 1/8 dogs exposed to saline aerosols, and may or may not be treatment-related. Rats receiving 1.2 mu Ci $^{238}Pu(NO_3)_4$ intramuscularly were treated promptly with 1.2 HD inhaled or intraperitoneally injected Ca-DTPA. The two methods of Ca-DTPA administration gave statistically identical Pu excorporation. Similar treatments initiated 8 months following the Pu injection also showed no effect of administration route. These experiments and implications for the safety and efficacy of inhaled Ca-DTPA as treatment for transuranic incorporations in man are discussed. (auth)

7604 (CONF-740379-, pp-93-123) PHYSIO-PHARMACOLOGICAL EFFECTS OF INSECTICIDES ON MAMMALIAN MUSCLE. Hashish, S. E.; Ibrahim, H. A. 1974.

From symposium on the use of isotopes in pesticides and pest control; Beirut, Lebanon (Mar 1974).

In use of isotopes in pesticides and pest control. (National Council for Scientific Research, Beirut (Lebanon); Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt)).

Experiments were designed to study the effects of the insecticides, Dipterex (organophosphate) and Sevin (carbamate) on

some physiopharmacological properties of a mammalian muscle. Rat diaphragm muscles in modified Krebs Saline were used for experimentation. The parameters tested were: the water phases of the muscle, the ion content (K and Na), the rates of entry and exit of radio-ions (^{42}K and ^{22}Na) and the muscle performance in terms of its isotonic contraction. Recovery experiments were also carried out. The results show that the physio-pharmacological effects of the insecticides can be explained in terms of neuromuscular block, membrane or surface phenomenon, and/or intracellular functional interferences. (auth)

7605 (CONF-751126-4) EFFECTIVENESS OF TRITIUM AND ^{239}Pu IN PRODUCING CHROMOSOME ABERRATIONS IN CHIRONOMUS RIPARIUS. Blaylock, B. G.; Trabalka, J. R. (Oak Ridge National Lab., Tenn. (USA)). 1975. 7p. Dep. NTIS $4.50.

From IAEA international symposium on biological effects of low level radiation pertinent to protection of man and his environment; Chicago, Illinois, USA (3 Nov 1975).

The existing literature on relative biological effectiveness (RBE) indicates that the high linear energy-transfer (LET) alpha-radiation of ^{239}Pu is more effective in the production of cytogenetic effects in mammalian cells in tissue culture than are forms of low LET radiation. The frequency of chromosome aberrations produced in the salivary gland chromosomes of insects (Chironomus riparius) by the low-energy beta rays from tritium were compared with those produced by the alpha radiation from ^{239}Pu. (auth)

7606 (CONF-751205-7) RETENTION OF PLUTONIUM IN MOUSE TISSUES AS AFFECTED BY ANTIVIRAL COMPOUNDS AND THEIR ANALOGS. Lindenbaum, A.; Rosenthal, M. W.; Guilmette, R. A. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 20p. Dep. NTIS $4.50.

From IAEA international seminar on diagnosis and treatment of incorporated radionuclides; Vienna, Austria (8 Dec 1975).

The chelating agent DTPA (diethylenetriaminepentaacetic acid) is an effective therapeutic substance for decorporation of extracellar monomeric plutonium in the mouse and dog, but is much less effective in removing intracellular polymeric plutonium (Pu-P). In the absence of effective therapy, this intracellular plutonium is long retained in the body, particularly in reticuloendothelial tissues like the liver. Our interest, therefore, turned to the development of adjunct substances capable of removing additional plutonium from the liver beyond that removable by DTPA alone. We showed that glucan, a yeast cell wall polysaccharide, is a useful adjunct to DTPA for removal of Pu-P from the mouse liver. Its toxicity, however, makes it a less than desirable drug for potential human use. Therefore, we initiated a search for more soluble (and presumably less hazardous) therapeutic agents similar to glucan, i.e., capable of adjunct action with DTPA. Of over 20 substances tested the most successful results were obtained with two antiviral, antitumor compounds, the pyran copolymers XA-124-177 and XA-146-85-2. These are condensation products of divinyl ether and maleic anhydride. Another analog, EMH-227, prepared by condensation of acrylic acid and itaconic acid, was similarly successful. Maximal removal of plutonium from mouse liver was obtained with a single intravenous (I.V.) injection of 10 to 90 mg/kg of pyran copolymer given 5 days after I.V. Pu-P administration. Although these doses increased splenic uptake of plutonium, a dose of 10 mg/kg produced a minimal increase in the splenic burden while producing maximal removal of hepatic plutonium. (auth)

7607 EFFECT OF THEOPHYLLINE ON THE UPTAKE OF ^{45}Ca IN THE GUINEA PIG AURICLE AS A FACTOR OF TIME. Mueller, R. Mainz; Univ. Mainz (1973). 31p. (In German). INIS.

Thesis.

The influence of theophylline in therapeutical concentration (5×10^{-4} g/ml) on the myocardial Ca balance was investigated as a factor of time by tests with radioactively labelled Ca (^{45}Ca) on isolated, electrically stimulated left guinea pig auricles. The activity uptake as well as the total intracellular Ca concentration were thus determined. In contrast to previous investigations, the extracellular Ca after the charging with ^{45}Ca was removed by washing the resting auricles in inactive Ca- and Na-free choline chloride solution. Theophylline increased the intracellular Ca fraction labelled with ^{45}Ca by 7.6% or 15.8%, as compared to the controls after 30 and 60 minutes charging time. Under the influence of theophylline, more cellular Ca could therefore take part in the transmembraneous Ca exchange than under control conditions. From the results it is concluded that theophylline also increases the exchangeable intracellular Ca fraction in the therapeutical concentration range. It is assumed that theophylline acts on intracellular structures and, by increased release of Ca from the SR or other intracellular Ca bonding positions, increases the quantity of ionized, contraction effective Ca in the cell. The question of whether this effect might be caused by the washing process after charging with ^{45}Ca requires further investigations. (GE)

7608 EFFECT OF EXTERNAL IRRADIATION BY GAMMA RAYS ON PLUTONIUM BEHAVIOR IN THE ORGANISM. Tregubenko, I. P. pp 59-63 of Teoreticheskie Voprosy Mineral'nogo Obmena. Genkin, A. M. (ed.). Moscow; Izdatel'stvo Nauka (1966). (In Russian)

External, total irradiation of rats with Co-60 gamma rays at doses of 300 R has no effect on the behavior of Pu-239 administered intraperitoneally in the form of citrate. Higher doses of 500 R change the behavior of plutonium (higher deposition in the skeleton and less in the liver), if given a few days after administering the radioactive emitter. Thus it is shown that even enormous doses of external irradiation ($LD_{30/30}$) cause insignificant changes in the behavior of plutonium in the organism. (SJR)

7609 AVAILABILITY OF A METAL FOR A COMPLEXING AGENT AND ITS RATE OF EXCRETION. Semenov, D. I.; Tregubenko, I. P. pp 64-73 of Teoreticheskie Voprosy Mineral'nogo Obmena. Genkin, A. M. (ed.). Moscow; Izdatel'stvo Nauka (1966). (In Russian).

A study was made of the efficiency of the complexing agents EDTA and DTPA in accelerating excretion of Y-91 deposited in tissues of an organism. It is shown that the rate of yttrium excretion with the urine decreases linearly with time both under normal conditions and also with the use of a complexing agent. This behavior indicates a difference in the state of the unexcreted yttrium in contact with a complexing agent. The direct dependence between the log of the amount of radioactive agent and the log of radioactive yttrium excreted by the complexing agent makes it possible to assume the existence of differently available fractions of yttrium metal in the tissues in definite equilibrium. A schematic model is proposed for the mutual relationships existing between complexed yttrium metal and metal fixed in the tissues. The problem is put forth on the change in the fraction of yttrium metal available for complexing, and also on the rate of exchange between the separate fractions of metal. This subject is of great interest in studying mineral exchange from a theoretical point of view, and also from the point of view of medical therapy by the use of complexing agents. (SJR)

7610 EFFECT OF THE TIME FACTOR AND THE INJECTION REPETITION FACTOR ON THE EFFICIENCY OF COMPLEXING AGENTS. Tregubenko, I. P.; Semenov, D. I. pp 74-83 of Teoreticheskie Voprosy Mineral'nogo Obmena. Genkin, A. M. (ed.). Moscow; Izdatel'stvo Nauka (1966). (In Russian).

The efficiency of using complexing agents is shown as a function of the time of application and of the number of injections. The decrease with time in the ability of a complexing agent to increase the excretion of yttrium with urine takes place more slowly than the decrease in the natural rate of excretion of yttrium. Differences in the efficiencies of the two complexing agents DTPA and EDTA increase with time. From the practical point of view (in poisoning with toxic metals) it is important to emphasize that the advantages of DTPA over EDTA become greater during later stages of excretion. With multiple use of injections the differences in efficiencies of the complexing agents remain constant within the limits of the duration of the experiment (2 weeks), in spite of the significantly greater excretion of yttrium from the organism with the use of DTPA. A look is taken at the problem of the differently available fractions of metal for complexing agents, and the variation in the ratio of efficiencies of DTPA and EDTA as a function of the injection time. The problem is put forth on measuring the fraction of metal in an organism available for complexing, and also the rate of conversion of available metal from nonavailable metal. By knowing the fraction of metal available for complexing it is possible to estimate objectively the efficiency of known, complexing agents and to direct the effort in a rational manner. (SJR)

7611 STUDY OF THORIUM BEHAVIOR IN THE ORGANISM AS A FUNCTION OF DOSE WEIGHT AND ENTRY MODE. Kach, A. Z.; Semenov, D. I.; Born, G. I. pp 14-26 of Teoreticheskie Voprosy Mineral'nogo Obmena. Genkin, A. M. (ed.). Moscow; Izdatel'stvo Nauka (1966). (In Russian).

A study was made of the behavior of micro- and macroamounts of thorium having isotopic and nonisotopic (cerium) carriers in the organism with various modes of entry. At all doses used in these experiments, thorium showed a high accumulation in the liver and spleen. This behavior is probably a result of the colloidal state of thorium in the blood and tissue liquids. An increase in weight dose decreases the deposition in the liver but raises it in the spleen and other organs. The type of distribution and excretion of thorium depends on the nature of the carrier. In the presence of nonisotopic cerium a higher concentration is

observed in the kidneys and bone marrow. The excretion of thorium is apparently accelerated. The resorption of trace amounts of uranium-X from subcutaneous tissue is 3 to 4% of the amount administered. The addition of stable isotopic (thorium) or nonisotopic (cerium) carriers almost completely eliminates the resorption of uranium-X_1. Uranium-X_1 is not adsorbed from the gastrointestinal tract. The behavior of the fraction of uranium-X_1 adsorbed from subcutaneous tissue differs substantially from its behavior on intravenous administration (significantly higher deposition in the skeleton and kidneys, less in the liver and spleen). This behavior indicates that even trace amounts of uranium-X_1 used in these experiments were not completely purified from carrier. Analogous results of previous experiments with lead indicate that we are dealing with a general regularity in behavior of metal ions. (SJR)

7612 CHANGE OF THORIUM DISTRIBUTION IN AN ORGANISM BY REACTION OF THE RETICULOENDOTHELIAL SYSTEM. Kach, A. Z.; Semenov, D. I.; Strel'tsova, V. N.; Born, G. I. pp 27-31 of Teoreticheskie Voprosy Mineral'nogo Obmena. Genkin, A. M. (ed.). Moscow; Izdatel'stvo Nauka (1966). (In Russian)

Severe blocking of the reticuloendothelial system and also the introduction of foreign protein change the ordinary distribution of thorium-234 administered intravenously. A decrease in thorium deposition is noted in the liver, while an increase is observed in other tissues and organs. The mechanism of this movement probably consists in mobilizing the Kupfer cells of the liver to the blood where they are phagocytized by the reticuloendothelial cells, mainly, of the spleen, and also of other organs. A noticeable increase in thorium elimination from the organism is not observed with the use of collargol, foreign serum or histamine. (SJR)

7613 EFFECT OF SODIUM CITRATE ON THORIUM BEHAVIOR IN AN ORGANISM. Kach, A. Z.; Born, G. I.; Semenov, D. I. pp 32-37 of Teoreticheskie Voprosy Mineral'nogo Obmena. Genkin, A. M. (ed.). Moscow; Izdatel'stvo Nauka (1966). (In Russian)

A study was made of the effect of sodium citrate on the magnitude of adsorption from the epithelium and on the character of the distribution of weighable amounts of thorium-234 in various tissues. Tests were also made of the possibility of accelerating the excretion of thorium from the organism by means of sodium citrate. Sodium citrate significantly increases thorium adsorption from the epithelium. The degree of absorption depends on the citrate dose and on the carrier (in the presence of nonisotopic carrier the degree of absorption is significantly higher). The character of the absorbed thorium tissue distribution possesses a number of features, but primarily it reduces to an increased deposition in the bone marrow as compared with a simple thorium salt. The behavior of simple and complexed thorium is also different during intravenous administration: complexed thorium accumulates to a lesser degree in the reticuloendothelial system, and to a greater degree in the skeleton. The eliminated thorium deposited in the tissue is not changed with prolonged intraperitoneal administration of sodium citrate. (SJR)

7614 STUDY OF THE BEHAVIOR OF THE RADIOACTIVE PAIR RADIUM D-RADIUM E IN THE ORGANISM. Born, G. I.; Kach, A. Z.; Semenov, D. I. pp 38-51 of Teoreticheskie Voprosy Mineral'nogo Obmena. Genkin, A. M. (ed.). Moscow; Izdatel'stvo Nauka (1966). (In Russian).

A study was made of the distribution of the radioactive pair radium D-radium E after intravenous administration of the radioactive emitters in secular radioactive equilibrium. The concentration of radium D and of radium E at various periods of time was determined by allowing tissue samples to attain radioactive equilibrium with subsequent mathematical treatment of the results. Formulas are presented for calculating the concentration of a daughter product in organs as a function of radioactive decay and as a function of the excretion of the parent and daughter substances. On the basis of these formulas, calculations were made of the theoretically expected amount of radium E at various periods of time under various assumptions: (a) the radium E formed in the organism remains at the site of occurrence, and (b) the radium E is excreted at the same rate as the administered radium E which is isolated. A comparison of the experimentally found concentrations with the theoretically expected concentrations gives rather good agreement with the above second assumption. The reliability of the observed deviations remains an open question. In a general way, reasons are considered for the different behavior of daughter products formed in the organism. It is assumed that the different microdistributions of the parent and daughter emitters should be of substantial significance. (SJR)

7615 PLUTONIUM DISTRIBUTION IN THE TISSUES AND ITS ELIMINATION FROM THE ORGANISM AS A FUNCTION OF THE PHYSICAL-CHEMICAL STATE AND MODE OF ENTRY INTO THE ORGANISM. Tregubenko, I. P. pp 52-58 of Teoreticheskie Voprosy Mineral'nogo Obmena. Genkin, A. M. (ed.). Moscow; Izdatel'stvo Nauka (1966). (In Russian)

Complexed plutonium behaves in the organism in the same way during intravenous injection as during intraperitoneal administration; it accumulates mainly in the skeleton (about 60%) with a content of 11 to 15% in the liver. Plutonium citrate, judging from its prolonged existence in the blood stream and its slow excretion from the organism, breaks down in the blood with the formation of colloidal or colloidal-like particles. The simple plutonium salt $PuCl_4$ on intravenous administration is adsorbed primarily by the liver (about 70%), while during intraperitoneal administration the adsorbed plutonium shows an "intermediate" type of distribution: 28% in the liver and 24% in the skeleton. The absorption of a simple plutonium salt from the peritoneal region in view of its rapid transformation to the colloidal state must be accomplished mainly through the lymphatic vessels. However, the simple plutonium salt is also partially adsorbed directly into the blood in the form of plutonium biocomplexes. (SJR)

7616 DIFFERENCES IN NATURAL CARBON ISOTOPE RATIOS OF MILK AND HAIR FROM CATTLE GRAZING TROPICAL AND TEMPERATURE PASTURES. Minson, D. J. (Commonwealth Scientific and Industrial Research Organization, Brisbane); Ludlow, M. M.; Troughton, J. H. Nature (London); 256: No. 5518, 602(14 Aug 1975).

It is stated that the fractionation of C in plants is due to preferential utilisation of ^{12}C and exclusion of ^{13}C in photosynthetic assimilation of CO_2. It has been found, however, that with the higher plants that fix CO_2 by the Calvin C_3 cycle pathway the $^{13}C/^{12}C$ ratios differ from plants that fix CO_2 through the C_4-dicarboxylic acid pathway. Temperate pasture species fix C by the former pathway and have $^{13}C/^{12}C$ ratios of about $-28‰$, whereas tropical pasture grasses fix C by the latter pathway with ratios of about $-12‰$. It has been suggested that isotope ratios of marine animal tissues reflect the ratio in their presumed diet, but there appears to have been no direct comparisons of the isotope ratios of higher animal tissues with those of the food eaten. The aim of the studies described was to compare the C ratios of tissues from animals grazing on pastures with different $^{13}C/^{12}C$ ratios. The tissues sampled were hair and milk, representing the products of long and short term absorption of nutrients, and the pastures grazed were composed of either temperate grasses or tropical grasses. The measurements were made with a ratio mass spectrometer. Large differences were found between the ratios found for milk and hair from C_3 and C_4 pastures. Results are shown tabulated and are discussed. Since the ratios for milk and hair are similar it is reasonable to assume that those for other animal tissues will show similar differences for differences in feeds. It is thought that the findings could have important implications for animal physiology, forensic science, and studies of animal evolution. (UK)

7617 RADIONUCLIDE RATIOS IN AGRICULTURAL AND BIOLOGICAL CHAINS IN THE CONTEXT OF THE PROBLEM OF RADIOACTIVITY PROTECTION OF THE ENVIRONMENT. Arkhilov, N. P.; Prister, B. S.; Romanov, G. N.; Sirotkin, A. N.; Ustinov, V. V.; Fedorov, E. A. (State Committee on Utilization of Atomic Energy, Moscow). pp 267-276 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975). (In Russian).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The results of experiments on the study of strontium-90 behaviour relative to stable calcium and the transition of radioactive strontium and caesium into animals under different conditions are reported. The dynamics of the variations of radionuclide ratios in agricultural production under radioactive fall-out effects is presented. The conditions for applying isotope ratios for the purpose of estimating radioactive levels in the environment are discussed. (auth)

7618 RADIOISOTOPE CONCENTRATION EFFECT IN BIOLOGY: ITS CONSEQUENCES IN THE USE OF RADIOACTIVE TRACERS. Guillot, P. (EURATOM, Brussels). pp 327-342 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Experiments with people inhaling mixtures of stable and radio-

active xenon (^{133}Xe) showed a radioisotope concentration effect (RICE): if, under the same conditions, various amounts of radioxenon mixed with a fixed amount of stable xenon are inhaled the whole-body activity (A/sub t/) of ^{133}Xe at any time t after inhalation is never proportional to the inhaled activity (I), as it should be on the hypothesis of identical behaviour of stable and radioactive xenon in the body. The experimental relationship can be described by a power function of the type: A/sub t/(I) equals k I/sup r/, where the exponent r is less than 1, for all t. This RICE has two important consequences for using radioactive tracers in biology. These consequences were experimentally confirmed with rats inhaling radioxenon mixtures, and with tomato plants absorbing stable and radioactive caesium from solutions: for simultaneous intake of two radioisotopes of the same element, the bigger the concentration ratio of the two radioisotopes in the intake, the bigger the relative difference between the two biological retentions of these radioisotopes; for simultaneous intake of the radioisotope and the stable isotope of the same element under identical conditions, the biological absorption of the radioisotope may be different from the biological absorption of the stable isotope, the differences depending on the relative concentrations of the isotopes. (auth)

7619 METABOLIC STUDIES WITH RADIOBISMUTH. I. Retention and Distribution of ^{206}Bi in the Normal Rat. Russ, G. A.; Bigler, R. E.; Tilbury, R. S.; Woodard, H. Q.; Laughlin, J. S. (Memorial Sloan-Kettering Cancer Center, New York). Radiat. Res.; 63: No. 3, 443-454(Sep 1975).

The retention of tracer doses of bismuth citrate in mature female rats indicated that there were three compartments which cleared exponentially. Two of these compartments were renal and accounted for 30 percent and 44 percent of the administered dose. The biological half-times of bismuth in these compartments were less than 30 min and 13 hr, respectively. The nonrenal compartment accounted for the remainder of the dose and its retention half-time was 122 hr. The major site of bismuth accumulation was in the kidney. Autoradiographs showed ^{206}Bi to be localized in the renal cortex. The kidney is shown to secrete ^{206}Bi into the urine and the renal extraction ratio is in excess of 0.92 for bismuth citrate. Whole-body scans at 24 hr do not reveal any other areas of concentration and demonstrate the applicability of this radionuclide as an imaging agent with conventional equipment. (auth)

7620 CALCULATION OF ABSORBED DOSE IN THE SKIN DURING ITS CONTAMINATION WITH RADIOACTIVE MATERIALS. Norets, T. A.; Il'in, L. A.; Shvydko, N. S.; Sheper, L. M. pp 233-239 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Experimental studies made on young pigs to determine the speed and depth of penetration of the radioisotopes ^{140}Ba, ^{89}Sr, ^{91}Y, ^{141}Ce, ^{144}Ce + ^{144}Pr, ^{143}Pr, ^{147}Nd, ^{99}Mo, and ^{132}Te applied to the skin in aqueous solutions of their salts. The radioactive materials partially penetrate the skin, either in ionic or colloidal form, and within 15 min of its application is distributed in all skin layers. About 5% of the applied quantity is found at depths greater than 30 μm within 15 min. All the isotopes studied have almost the same distribution in the skin layers which indicates a great similarity in their pattern and mechanism of penetration. The distribution can be described by a two-component exponential relation, which is characterized by a rapid decrease of the concentration in the layers from 0 to 200 μm and a very slow decrease at greater depths. The distribution of the isotopes with a soft β radiation leads to an increase of the dose in comparison with the surface distribution. Skin penetration of radioactive substance in relatively small quantities can create conditions with repeated contamination of the skin of continuous irradiation of the skin at its lower layers. (JSR)

7621 MICRODISTRIBUTION OF THE ABSORBED DOSE IN THE SKIN DURING ITS CONTAMINATION WITH γ and β EMITTERS. Osanov, D. P.; Ershov, E. B.; Klykov, O. V.; Rakova, V. A. pp 239-246 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The dependence of the concentration of ^{239}Pu and ^{89}Sr penetrating into the skin on the depth under the skin surface was experimentally determined on young pigs. The curves obtained were used to calculate the microdistribution of the absorbed dose in the skin. Both results are shown graphically. They indicate that the contribution the radioisotopes absorbed by the skin to the total irradiation dose of the basal layers cannot be neglected. (JSR)

7622 ENTRAPMENT OF RADIOACTIVE AEROSOLS IN THE HUMAN RESPIRATORY ORGANS AND EVALUATION OF THE MAGNITUDE OF THEIR ACCUMULATION. Parkhomenko, G. M.; Sayapina, R. Ya.; Bad'in, V. I.; Sit'ko, R. Ya. pp 246-248 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The entrapment of aerosols of Pu, long-lived β-active isotopes, ^{220}Rn, and Po was studied under professional conditions as a function of particle radius ranging from 0.019 to 30.2 μm. The dependence of the differential entrapment coefficient on the radium was determined. As 11.5% of the air activity is deposited in the nose, the determination of the activity of nasal smears can be used for evaluating the inhalation accumulation during the course of a working day. (JSR)

7623 DECONTAMINATION OF ARENICOLA MARINA (ANNELIDE, POLYCHETE) AFTER EXPERIMENTAL CONTAMINATION BY ^{137}Cs OR ^{60}Co. Amiard-Triquet, C. (CEA, Fontenay-aux-Roses, France). Mar. Biol.; 26: No. 2, 161-165(1974). (In French)

A comparative study was made on the elimination of ^{137}Cs and ^{60}Co by A. marina after experimental contamination. Significant decontamination of ^{137}Cs is possible, but elimination of ^{137}Cs accumulated in muscle tissue is very slow. The elimination of ^{60}Co is also very slow. The biological half-life of ^{60}Co in A. marina is about 3 mo. (Pollut. Abstr.)

7624 FLUORO-DOPA: A UNIQUE GAMMA EMITTING SUBSTRATE FOR DOPA DECARBOXYLASE. Firnau, G. (McMaster Univ. Medical Center, Hamilton, Ont.); Garnett, E. S.; Sourkes, T. L.; Missala, K. Experientia; 31: No. 11, 1254-1255(1975).

Experiments were designed to determine how ^{18}F-fluoro-dopa was handled by the enzyme dopa decarboxylase. The product of decarboxylation was identified; the kinetics of the reaction in kidney and brain tissue were measured; and the effects of adding the coenzyme, pyridoxal-5'-phosphate, or the inhibitor, α-methyl-dopa, were investigated. The potential use in brain studies is proposed. (HLW)

7625 INVESTIGATION OF ABSORPTION OF ^{137}Cs BY KRILL. Tolkach, V. V.; Gromov, V. V.; Spitsyn, V. I. (Inst. of Physical Chemistry, Moscow). Dokl. Biol. Sci.; 220: No. 1-6, 11-13(1975).

Translated from Dokl. Akad. Nauk SSSR; 220: No. 1, 223-226 (Jan 1975).

The absorption and elimination of ^{137}Cs, under almost natural conditions, was investigated in krill taken from the Ross Sea from January to March, 1973. It was found that the assimilation of ^{137}Cs by the krill was nearly complete during the first day after exposure and a stationary state was reached after 1.5 days. A correlation of 0.96 was obtained between the experimental data obtained and the theoretical curves obtained for the kinetics of absorption when calculated using an equation describing the assimilation of microelements by phytoplankton. A curve illustrating the withdrawal of ^{137}Cs from live krill shows that elimination of the ^{137}Cs ceases after 3 days. The krill does not approach a thorough self-cleansing of ^{137}Cs. Only 10 to 15% of the initial absorbed dose is eliminated, with the remaining ^{137}Cs probably attached to the walls of the gut. It should be noted that the coefficients of accumulation obtained in this investigation were small. If krill were to eat phytoplankton containing ^{137}Cs, then the coefficients of accumulation for radiocesium might be higher. (ERB)

7626 ROLE OF BILE IN INTESTINAL ABSORPTION OF ^{203}Pb IN RATS. Cikrt, M.; Tichy, M. (Inst. of Hygiene and Epidemiology, Prague). Experientia; 31: No. 11, 1320-1321 (1975).

Absorption of ^{203}Pb after administering intraduodenally ^{203}Pb eliminated with bile was studied. The results obtained were compared with absorption of ^{203}Pb administered into the duodenum as $^{203}PbCl_2$ in rats forming 2 groups, one with bile ducts cannulated, the other intact. It was found that bile played an important role in absorption of Pb from the gastrointestinal tract. Absorption of ^{203}Pb is significantly reduced if the bile is drained off by means of a cannula. (auth)

7627 EFFECT OF LUTEINIZING HORMONE ON CHICKEN TESTIS AND PINEAL GLAND UPTAKE OF ^{32}P. Sackman, J. W. (Indiana Univ., Bloomington). Experientia; 31: No. 11, 1362-1364 (1975).

The glandular uptake of radioactive phosphorus (^{32}P), administered carrier-free, was used as an endpoint for the study of the effects of luteinizing hormone (LH) on the testis and pineal gland of 3-, 10-, and 13-day-old White Leghorn cockerels. Pineal uptake of ^{32}P of the 13-day-old birds decreased and testis uptake of

^{32}P increased following LH treatment. Maximum effects were observed when 20 μg LH was administered 4.0 h before autopsy. Although testis uptake of ^{32}P increased following LH treatment in 3- and 10-day-old cockerels, pineal uptake of ^{32}P remained unchanged. (auth)

7628 INDIUM-113m-LABELED POLYFUNCTIONAL PHOSPHATES AS BONE-IMAGING AGENTS. Subramanian, G.; McAfee, J. G.; Rosenstreich, M.; Coco, M. (Upstate Medical Center, Syracuse, NY). J. Nucl. Med.; 16: No. 11, 1080-1084(Nov 1975).

Indium-113m complexed with polyfunctional phosphonates EDTMP (an analog of EDTA with carboxylic groups replaced by phosphate groups) and DTPMP (an analog of DTPA) showed preferential skeletal localization in experimental animals. Excellent images of the rabbit skeleton were obtained with both /sup 113m/In and ^{111}In complexes using the scintillation camera. In tissue radioassay using ^{85}Sr as a simultaneous biologic standard, /sup 113m/In-EDTMP compound showed higher concentration in the skeleton than the DTPMP complex and its bone uptake was comparable to that of ^{85}Sr. Renal excretion was greater for the DTPMP complex (70 percent vs. 50 percent for EDTMP at 4 hr) and its blood clearance was faster than EDTMP. EDTMP was found to be the superior agent also to two other polyfunctional phosphonates, NTMP and HMDTMP. Because of the excellent skeletal localization with minimal soft-tissue levels, /sup 113m/In-EDTMP may find use in bone scanning in humans wherever /sup 99m/Tc bone-imaging agents are not available. These compounds may prove useful also in demonstrating acute myocardial infarcts, particularly for repeat studies after /sup 99m/Tc bone agents have already been administered. (auth)

7629 CHEMICAL AND BIOLOGIC PROPERTIES OF ISOLATED RADIOLABELED BLEOMYCIN PREPARATIONS. Eckelman, W. C.; Rzeszotarski, W. J.; Siegel, B. A.; Kubota, H.; Chelliah, M.; Stevenson, J.; Reba, R. C. (Washington Hospital Center, Washington, DC). J. Nucl. Med.; 16: No. 11, 1033-1037(Nov 1975).

Cobalt-57-bleomycin is a diagnostically useful radiopharmaceutical, but little is known about the nature of its individual fractions in regard to their metal-binding capacity and their in vivo distribution. Bleomycin was separated by high performance liquid chromatography (HPLC) into four major components. These were labeled and the distribution studied in tumor-bearing rats at 2 and 24 hr. In vivo radiochemical purity was also determined. (CH)

7630 NEW AND SUPERIOR ADRENAL SCANNING AGENT, NP-59. Sarkar, S. D.; Beierwaltes, W. H.; Ice, R. D.; Basmadjian, G. P.; Hertzel, K. R.; Kennedy, W. P.; Mason, M. M. (Univ. of Michigan, Ann Arbor). J. Nucl. Med.; 16: No. 11, 1038-1042(Nov 1975).

The first synthesis of ^{131}I-19-iodocholesterol had a 10 to 25 percent radiochemical impurity that was not iodide ion. This impurity has been identified as 6 beta-^{131}I-iodomethyl-19-nor cholest-5(10)-en-3 beta-ol (NP-59) and has been synthesized. Tissue distribution studies with ^{131}I-NP-59 in rats and dogs revealed a higher adrenal uptake and adrenal-to-tissue ratios compared to ^{131}I-19-iodocholesterol, probably less in vivo deiodination, and superior adrenal images. A high uptake was seen in the adrenal medulla in addition to that in the cortex. Iodine-131-NP-59 is being evaluated for the early detection of adrenal-cortical disorders and as a potential scanning agent for detecting structural abnormalities of the adrenal medulla. (auth)

7631 SODIUM TRIMETAPHOSPHATE AS A BONE-IMAGING AGENT. I. Animal Studies. Nelson, M. F.; Melton, R. E.; van Wazer, J. R. (Vanderbilt Univ., Nashville). J. Nucl. Med.; 16: No. 11, 1043-1048(Nov 1975).

When used in conjunction with stannous ion and ^{99}Tc, the nonsequestering, cyclic, trimeric phosphate anion, $(P_3O_9)^{3-}$, introduced in the form of its sodium salt, exhibits admirable properties as a bone-visualizing agent as demonstrated by studies in mice. These studies show that this combination is easily prepared reproducibly and, compared to the agents described in the recent literature (all based on sequestering phosphates), is at least equivalent for bone visualization while being considerably less toxic. (auth)

Plants

7632 TRITIUM BEHAVIOR PATTERN IN SOME SOIL-PLANT SYSTEMS IN A TROPICAL ENVIRONMENT. Soma, S. D.; Iyengar, T. S.; Sadarangani, S. H. Vaze, P. K. (Bhabha Atomic Research Centre, Trombay, India). pp 195-210 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

A study of the distribution pattern of tritium in the soil/plant environment gives a valuable ecological information on the natural water balance. The results of such a study for the conditions obtaining in India are given in this paper. Field studies are carried out by injection of tritium into some soil/plant systems and following the transfer pathways. The method of extraction for tissue-free-water-tritium (TFWT) is based on the vacuum freeze-drying technique while the tissue-bound-tritium (TBT) is estimated by a modified version of the Shoniger method. The determination of residence time of tritium in aqueous and organic phase in a number of tropical trees has been carried out both for stem-injection as well as intake from the soil. From the results of this study the tree biomass and transpiration rates have been determined. The tritium profile over time, for an acute exposure in certain trees such as Morinda Tinetoria, Achras Sapota etc. shows significantly different patterns compared to the normal pattern shown by Mangifera Indica, Terminalia Catappa, Ficus Glomerata etc. The period of investigation in each case varied from 400 to 1000 h. In most of the cases, the TBT fractions were very low compared to TFWT fractions in the initial stages. The tritium behaviour in the tree reflects significant characteristics of the tritium behaviour in the soil system. The authors have found that the leaf sampling can be used as an indicator of total environmental tritium behaviour. (auth)

7633 MEAN RESIDENCE TIMES FOR TRITIUM IN SOME TERRESTRIAL PLANTS. Gogate, S. S.; Krishnamoorthy, T. M.; Soman, S. D. (Bhabha Atomic Research Center, Bombay). Indian J. Exp. Biol.; 13: No. 3, 264-267(May 1975).

Uptake of tritiated water from a single or multiple exposure, its fixation and elimination from three terrestrial plants, Raphanus sativus L., Amaranthus viridis L., and Phyllanthus fraternus Webster under experimental field conditions are described. Tissue free water tritium (TFWT) attains peak concentration within 4 hr after a single exposure in R. sativus and then decreases with a single component from both leaves and root, with a biological half-time of 36.4 ± 4.2 and 48.5 ± 7.2 hr respectively. TFWT in leaves of A. viridis reaches its peak value within 0.5 hr of exposure and its decay exhibits two component fall, one having a very short half life of 2.4 ± 0.7 hr and the other a long half time of 86.1 ± 2.0 hr. The two component decay of tritium in TFWT is well represented in P. fraternus. The long lived components are nearly 8 times that of the short lived ones, both in leaves and stems respectively. Generally the long lived component accounts for 15% of the peak TFWT. Tissue bound tritium (TBT) reaches to 4% of TFWT in Phyllanthus sp. TBT elimination time is many times longer than the experimental periods employed in the present study. (auth)

Microorganisms

7634 (BNWL-SA-5531) MICROBIAL TRANSFORMATION OF PLUTONIUM. Robinson, A. V.; Garland, T. R.; Schneiderman, G. S.; Wildung, R. E.; Drucker, H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 12p. (CONF-750985-3). Dep. NTIS $4.50.

From 15th Hanford life sciences symposium; Richland, Washington, USA (25 Sep 1975).

Analytical results indicate the reaction of Pu and fungal metabolites possibly occurs in the cell and the Pu compounds are then released into the exocellular media. Research has demonstrated that Pu-resistant microorganisms which have the ability to change the chemical form of a highly stable Pu complex can be isolated from soil. Continued research will be directed toward determination of the ability of Pu-resistant soil microbial isolates (maintained in stock cultures) to alter the solubility and mobility of the largely insoluble forms of Pu present in the environment. Since these studies involve a systematic investigation of the major classes of soil organisms, determination of their ability to alter Pu form in soil as well as in vitro and evaluation of the soil and environmental factors influencing their ability to transform Pu, the results should ultimately provide a realistic evaluation of the behavior of Pu in soil and the availability of Pu metabolites to plants. (CH)

New Tracer Techniques

Refer also to abstracts 7012, 7024, 7358, 7367, 7370, 7372, 7503, 7590, 7601, 7619, and 7628–7630.

7635 (AED-CONF-74-648-001) POSSIBILITIES OF DOSE REDUCTION IN MICTURITION CYSTOURETROGRAPHY. Schuster, W.; Heinrich, H. (Giessen Univ. (F. R. Germany). Zentrum fuer Radiologie). 1974. 5p. (In German). INIS.

From 11th annual meeting of the Gesellschaft fuer Paediatrische Radiologie; Wuerzburg, F. R. Germany (24 Oct 1974).

8 figs.; 1 tab.; 4 refs.

Dose reduction in radiological diagnostics can be achieved by suitable X-ray equipment as well as investigation techniques. In the Erlangen children's clinic (FRG), a few equipment possibilities were quantitatively investigated, e.g. the extensive application of image intensifying systems or variable exposure automatics. In the investigation techniques for vesical tests, positions were found where the dose exposure of the patient was a minimum. (GE)

7636 (AED-CONF-75-141-016) 3-D IMAGES OF SCINTIGRAMMES MADE WITH FRESNEL-ZONE PLATES. Reinhardt, E. R.; Fritz, W. (Stuttgart Univ. (TH) (F. R. Germany. Inst. fuer Physikalische Elektronik). 1975. 10p. (In German). INIS.

From 6th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik; Berlin, F. R. Germany (28 Apr 1975).

7 figs.; 6 refs. With abstract.

The possibility of producing 3-D images of γ-emitters using zone plates is discussed in the light of experimental results. For clinical use in nuclear medicine, an image system for 3-D real images with high spatial resolution can be designed using the coded-aperture principle. Advantages and disadvantages of on-axis and off-axis zone plates are discussed. A new two-image method which combines the advantages of off-axis and on-axis zone plates was realized in a light-optical simulation. The conventional collimater systems were compared with the off-axis zone plate method and the two-image process. (GE)

7637 (BMFT-FBK-75-05) COMPARISON OF CONVENTIONAL AND NUCLEAR MEDICINE RESEARCH METHODS IN THE AREA OF NEPHRO-UROLOGY. Pfannenstiel, P. (Deutsche Klinik fuer Diagnostik, Wiesbaden (F.R. Germany)). Oct 1975. 208p. (In German). Dep. NTIS (US Sales Only) $8.75.

A simplification of the ^{131}I-hippuran total body clearance method for testing kidney function is described. The renal clearance can now be calculated with only one scintillation detector after i.v. injection of ^{131}I-hippuran. (CH)

7638 (LBL-3040) COMPARISON OF HEAVY CHARGED PARTICLES AND X-RAYS FOR AXIAL TOMOGRAPHIC SCANNING. Huesman, R. H.; Rosenfeld, A. H.; Solmitz, F. T. (California Univ., Davis (USA). Dept. of Engineering). Sep 1975. Contract W-7405-ENG-48. 16p. Dep. NTIS $4.00.

Heavy charged particles are applicable to the problem of 3-dimensional reconstruction of electron density distributions of biological samples. The transverse uncertainty in the path of a heavy charged particle due to multiple scattering can be reduced by measuring the entrance and exit positions and angles of the particle. Patient doses for He ions and 80 keV x rays are compared under conditions suitable for imaging the human head. (auth)

7639 (N-75-23143) VALIDITY OF DETERMINATION OF DIURNAL CORTISOL PRODUCTION RATE BY ISOTOPE DILUTION METHOD. Massalski, W. Translated from Pol. Arch. Med. Wewn.; 4: No. 52, 329-334(1972). 10p. NTIS $3.25.

Examined is a basic assumption made in all methods attempting to determine the diurnal cortisol production rate by determination of the specific activity of one of its metabolites, namely that the radioactive steroid is metabolized in the same pathways and in an identical manner as its nonradioactive counterparts. It is shown that the presence of the radioactive isotope may lead to considerable changes in enzymatic activity. Since the specific activity of different cortisol metabolites determined in one person is not the same, the differences being as high as 60 percent of the value, there is no theoretical basis for an accurate determination of the diurnal cortisol production rate by the isotope dilution method. (STAR)

7640 DETERMINATION OF DENSITY AND THICKNESS OF FINGER BONES WITH AN IODINE 125 PROFILE SCANNER. Reproducibility and Accuracy of Different Evaluation Methods. Seybold, K. Wuerzburg, Ger.; Wuerzburg Univ. (1974). 75p. (In German). INIS.

Thesis.

The density of compacta and spongiosa of the finger bone was determined from the attenuation coefficients using an ^{125}I profile scanner. Possible sources of error are critically tested and various methods of evaluation are compared. The dependence of the bone density and thickness on age is investigated in a larger test sample. (GE)

7641 RADIOCARDIOGRAPHIC MEASUREMENT OF MINIMUM CENTRAL TRANSIT TIMES BY MEANS OF INDIUM-113m-DTPA AND OF A 8-CRYSTAL RADIOCARDIOGRAPH (GAMMA RETINA VI). Comparative Investigations on Non-Trained and Athletics in Repose and After Stress. Knapp, W. H. Dusseldorf; Dusseldorf Univ. (1972). 11p. (In German). INIS. Thesis.

The minimum cardiac transit times (MTT's) at rest and following sub-maximum stresses were measured in 97 individual examinations of untrained persons and high performance athletes. It turned out that there is a strong dependence on cardiac frequency of the MTT's. This relation can be described quite satisfactorily by a hyperbolic function and in this way allows a frequency correction to be made of the MTT's. The MTT's standardized in this way (MTT · f values) represent the quotient of the end diastolic segment volume/beat volume. In the whole lesser circulatory system almost identical MTT · f values were found for the two groups under comparison at rest and following stress. In the ventricles, however, and especially so in the left ventricle, the MTT · f values were clearly higher with athletes than with untrained persons, but they strongly decreased after stresses, while the respective values remained almost constant in ordinary persons. (GE)

7642 ^{131}I SERIAL SCANNING OVER THYROID AS A METHOD TO DIFFERENTIATE ADENOMATOUS GOITRE FROM FOLLICULLAR CARCINOMA: A PRELIMINARY REPORT. Padmanabha Rao, M. A. (All India Inst. of Medical Sciences, New Delhi). pp 185-191 of Proceedings of the Fifth Asia and Oceania Congress of Endocrinology. Rastogi, G. K. (ed.). Chandigarh, India; Endocrine Society of India (1974).

From proceedings of the fifth Asia and Oceania Congress of Endocrinology; Chandigarh, India (28 Jan 1974).

An attempt was made to differentiate between the adenomatous goiter and follicular carcinoma of thyroid based on differences in their ^{131}I clearances. Following ^{131}I administration thyroid scanning was performed at intervals, up to 15 days, commencing from 24 hours, using a digital scanner. From the digital scan data ^{131}I differential clearance from individual lobes was further estimated in each case. The cases that showed cold nodules were excluded from the study. Of the eight cases of goiter studied, five were operated subsequently for which histological evidence is available. Histologically confirmed adenomata were found to exhibit a delayed clearance of ^{131}I as compared with that of the rest of the normal thyroid. The nodular areas of follicular carcinoma showed rapid ^{131}I clearance as compared with the rest of the normal parenchyma or that of adenomatous goiter. The results suggest that ^{131}I serial scanning may serve as a useful preoperative diagnostic tool to differentiate between nonmalignant goiter and thyroid cancer. (auth)

7643 COMPARISON OF TWO METHODS OF MEASURING $^{14}CO_2$ RESPIRED BY PLANTS. Ryman, R. G.; Powell, C. E.; Ryle, G. J. A. (Grassland Research Inst., Hurley, Eng.). Int. J. Appl. Radiat. Isot.; 26: No. 8, 483-484(Aug 1975).

To obtain comparative measurements for a scintillation flow cell and an ionization chamber for $^{14}CO_2$ assay, each system was tested with varying concentrations of $^{14}CO_2$ in air and their respective sensitivities and efficiencies obtained. Their use in measuring plant respiration was evaluated. (UK)

7644 THYROID. Atkins, H. L. pp 671-707 of Clinical Scintillation Imaging. Freeman, L. M. (Ed.). New York; Grune and Stratton, Inc. (1975).

Thyroid imaging remains one of the most common and useful nuclear medical techniques. It provides information essential in understanding the functional anatomy of the gland. While not absolutely diagnostic insofar as thyroid malignancy is concerned, the procedure is extremely useful in conjunction with other clinical information in providing a rotational approach to the patient with a thyroid nodule. Advances in recent years include the use of newer radionuclides, /sup 99m/Tc, ^{125}I, ^{123}I, as well as tumor-scanning agents such as ^{75}Se-selenomethionine, ^{131}Cs, and ^{67}Ga. The gamma camera has added an extra dimension in terms of dynamic function studies. Looking forward to the future we can expect further improvement in equipment and availability of radionuclides, which will greatly enhance the quality of the exam. The development of a solid-state germanium detector camera[112] will avoid the necessity of the pinhole collimator, yet provide resolution of approximately 2 mm with enhanced sensitivity. Radioiodine 123 may replace all presently used nuclides when it becomes available from high-energy accelerators at Brookhaven National Laboratory, Los Alamos Scientific Laboratory, and perhaps some other installations at reasonable cost and in quantity sufficient for clinical use. Although nuclide imaging of other organs has been and most likely will continue to be a larger relative share of nuclear medicine, the thyroid should continue to occupy a central position in this field. (auth)

7645 SOIL RESPIRATION AND ACTION OF MINERALS. Freytag, H. E.; Igel, H. Zentralbl. Bakteriol. Parasitenk., Abt. II; 128: 221-231(1973). (In German).

Equal amounts of glucose-1-6^{14}C were applied to soil in the presence of N, P, K or NPK in special respirometer vessels. As a result of N-deficiency, an inhibition of glucose-C-mineralization occurred in the case of P or K application only. Especially the economic coefficient of the C-mineralization was high when K only was added (44-50%; for NPK or P 34-37%, respectively). It was the slowness of the tranformation process, attributed to the N-deficiency, which had lead to this high coefficient of glucose-C-conservation, and not a result of K application directly. In this regard, a positive correlation between the economic coefficient and the intensity of glucose decomposition was found. The possibility of obtaining a higher accumulation of organic substances in soil by means of a reduced velocity of the decomposition processes was discussed. (auth)

7646 TOTAL BODY FAT DETERMINATION USING THE TRITIUM DILUTION METHOD AND ITS CORRELATION WITH CARBOHYDRATE TOLERANCE. Wuestenberg, P. W.; Holtz, M.; Krueger, M.; Naumann, G.; Potschwadek, B.; Rhomann, H. Z. Gesam. Inn. Med. Ihre Grenzgeb., Suppl.; 29: No. 24, 1004-1007 (15 Dec 1974). (In German).

The establishment of the whole content of the body fat of the organism is necessary for the judgement of the fatty tissue, taking into consideration the development of the carbohydrate intolerance and diabetes mellitus, apart from the classification of the forms of obesity into hyperplastic and hypertrophic types. On the basis that the lean body mass of the organism shows a relatively constant water content by ascertainment of the whole body water the fat content of the body can be calculated. (auth)

7647 MORPHOLOGICAL BACKGROUND OF RADIOISOTOPE SCANOGRAMS OF THE LUNGS. Agzamov, R. A.; Gingsburg, V. S. (Uzbek Scientific-Research Inst. of Tuberculosis, Tashkent). Probl. Tuberk.; 51: 14-17(1973). (In Russian)

Radioisotope scanning effected in 48 patients with restricted and extensive destructive forms of pulmonary tuberculosis formed a basis for the study of the blood supply of the lungs. Scanograms were contrasted against the histological structure of the sections of the lungs removed during operative interventions, wherefrom "Cristelle's slices" were obtained. It was made certain that the character of the scanograms reflects fairly well the functional completeness of the vascular bed. (auth)

7648 MEASUREMENT OF PANCREATIC BLOOD FLOW IN DOG BY ^{133}Xe CLEARANCE TECHNIQUE. Ercan, M. T.; Bor, N. M.; Bekdik, C. F.; Oner, G. (Hacettepe Univ., Ankara). Arch. Gesam. Physiol.; 348:.5-57(4 Apr 1974).

The water/gas, plasma/gas, erythrocyte/gas and pancreas/gas partition coefficients of ^{133}Xe were measured at 37°C using dog tissues. The pancreas/blood partition coefficients were calculated from these figures and plotted as a function of hematocrit. The ^{133}Xe pancreas/blood partition coefficient in the normal range was 1.2 ml/g. Pancreatic blood flow was determined in each case by injecting the tracer into the pancreaticoduodenal artery (mean 106.8 ± 30.4 ml/100 g/min). Pancreatic blood flows were also determined by injecting the tracer into the tissue of head, body, and the tail of pancreas. The means of the results were 62.4 ± 22.2, 85.7 ± 35.6, and 67.1 ± 26.4 ml/100 g/min respectively. The mean pancreatic blood flow obtained by intra-arterial injection was significantly different ($P < 0.05$) from the results obtained by injecting ^{133}Xe into the head or tail, but was not statistically different from that of the body of pancreas. The results of the head, body, and tail of pancreas were not significantly different from each other ($P > 0.05$). (auth)

7649 FUNCTIONAL PULMONARY EXPLORATION USING A SCINTILLATION CAMERA AND ^{133}Xe. Test Procedure and Data Handling. Demedts, M.; de Roo, M.; Vandecruys, A.; Kiebooms, L.; Drieskens, L.; Cosemans, J. Respiration; 31: No. 6, 484-502(1974). (In French)

A procedure for measuring regional ventilation, perfusion and V/Q-ratio by means of a gamma camera and ^{133}Xe is explained and discussed. Computer programs to correct the deformations of the initial results, to delimitate the lungs, to calculate the indexes and wash-outs, and to perform the final print-outs are discussed. Some results in patients are shown. (auth)

7650 FIELD MEASUREMENTS OF N-UTILIZATION EFFICIENCY AND NITRATE MOVEMENT IN SOILS USING ^{15}N-DEPLETED FERTILIZER. Broadbent, F. E. (Univ. of California, Davis). pp 373-382 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

A field experiment consisting of 48 plots on Yolo fine sandy loam was set up with 4 levels of fertilizer, 0, 90, 180, and 360 kg N/ha applied as $(NH_4)_2SO_4$ containing less than 0.003 at. percent ^{15}N. Three irrigation regimes equivalent to 1/3, 3/3, and 5/3 of the normal evapotranspiration (ET) curves for maize at this location were used. Isotopic composition of components of the maize crop was very uniform at a given fertilizer level. Efficiency of fertilizer N uptake by the crop ranged from 33 percent at the 360 kg level to 53 percent at the 90 kg level. Analysis of soil solutions at various depths in the soil over the season showed that very little fertilizer-derived nitrate moved below the root zone unless both fertilizer level and amount of water applied was excessive. (auth)

7651 MEASUREMENT OF WATER AND NITROGEN FLUXES IN SOIL PROFILES PLANTED TO MAIZE. Biggar, J. W.; Nielsen, D. R.; Macintyre, J. L. (Univ. of California, Davis). pp 417-428 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

A field experiment to study the flux of water and nitrogen from the root zone of maize during growth and the following fallow period is described. The experiment includes four rates of fertilizer applied as ^{14}N in ^{15}N-depleted NH_4SO_4, and three irrigation regimes. Tensiometers for measuring soil water pressure, neutron probes for measuring soil water content and suction probes to obtain soil solution samples are located in the experimental area. Water is supplied by sprinkler irrigation. Results demonstrate the responsiveness of the instruments and the wide differences in water movement out of the root zone. Nitrogen losses are largest under the wettest treatment although very little of the N lost appears to have been derived from the fertilizer applied at the beginning of the experiment. The fate of nitrogen in the Soil-Water-Plant system is partially controlled by the behaviour of the water in the soil. Previous work has shown that the soil water content and the soil water flux must be considered when accounting for microbial transformations, movement of nitrogen in the soluble and gaseous forms, mixing of solutes in homogeneous and non-homogeneous soil profiles and transport of this nitrogen out of the root zone and the extraction of nitrogen by plants. (auth)

7652 MEASUREMENT SYSTEM FOR TOTAL NITROGEN AND ^{15}N/^{14}N IN PLANT TISSUE, SOIL, AND WATER. Walker, R. L.; Walton, J. R.; Carter, J. A.; Matthews, D. R. (Oak Ridge National Lab., TN). pp 429-438 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

The ability to follow the behaviour of nitrogen in environmental systems has led to the development of an analytical system which can measure the quantity and isotopic abundance of nitrogen in a variety of samples. A reductive pyrolysis unit and a directional focusing 6-inch radius gas mass spectrometer were combined into the system. In the reductive pyrolysis part of the system, nitrogen species are converted to ammonia in an atmosphere of hydrogen in the presence of a heated nickel catalyst. A small amount (approximately 5 percent) of the resulting ammonia is directed into a cold finger reaction vessel where it is converted to nitrogen for isotopic analysis by mass spectrometry. The ammonia is decomposed thermally to nitrogen and hydrogen employing a rhenium filament heated to 1050°C. The nitrogen from the decomposition is used for measuring the abundance of masses 28 and 29; the ^{15}N abundance of masses 28 and 29; the ^{15}N abundance is calculated from the measured ratios. The system has been used to analyze vegetation and water samples with precisions of 0.5 per cent of the ^{15}N/^{14}N value at the normal isotopic range and 6 percent for the quantitative analysis. The minimum sample size required for a complete analysis is 20 mu g of nitrogen. Three samples can be completed in an hour using multiple reaction vessels. (auth)

7653 NITROGEN ISOTOPE RATIOS IN SURFACE AND SUB-SURFACE SOIL HORIZONS. Rennie, D. A.; Paul, E. A. (Univ. of Saskatchewan, Saskatoon). pp 441-453 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior of indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Nitrogen isotope analysis of surface soils and soil-derived nitrate for selected chernozemic and luvisolic soils showed mean delta ^{15}N values of 11.7 and 11.3, respectively. Isotope enrichment of the total N reached a maximum in the lower B horizon. Sub-soil parent material samples from the one deep profile included in the

study indicated a delta ^{15}N value (NO_3-N) of ⅓ that of the Ap horizon, at a depth of 180 cm. The delta ^{15}N of sub-surface soil horizons containing residual fertilizer N were low (-2.2) compared to the surface horizon (9.9). The data reported from this preliminary survey suggest that the natural variations in ^{15}N abundance between different soils and horizons of the same soil reflect the cumulative effects of soil genesis and soil management. More detailed knowledge and understanding of biological and other processes which control N isotope concentrations in these soils must be obtained before the data reported can be interpreted. (auth)

7654 ISOTOPE EFFECTS IN RELATION TO THE INTERPRETATION OF $^{15}N/^{14}N$ RATIOS IN TRACER STUDIES. Edwards, A. P. (Univ. of Nebraska, Lincoln). pp 455-468 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975).

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Data from aerobic incubation studies involving application of ^{15}N-depleted, ^{15}N-enriched and natural-abundance aqua-ammonia fertilizer to a Webster soil have been used to calculate the change in isotope concentrations produced by isotope effects acting on the portion of the fertilizer ammonium converted to nitrate. The nitrate-N from the fertilizer sources contained significantly more ^{15}N than the ammonium-N applied, which is exactly opposite to the result to be expected in a pure system where ammonium is undergoing partial nitrification only. A model to explain these results, and to illustrate the probable sequence of changes in cropped soils, is presented. The significance of isotope effects with respect to the interpretation of $^{15}N/^{14}N$ ratios actually measured during tracer investigations is greatest where an attempt is made to use the natural-abundance approach to quantitative separation of sources. The possibility of using small changes in isotope concentration to elucidate soil reaction mechanisms is shown to be extremely unlikely because partial conversions of unknown magnitude are the rule rather than the exception in soils. (auth)

7655 VARIATIONS IN THE $^{13}C/^{12}C$ ISOTOPIC RATIO IN THE ANIMAL METABOLISM. Lacroix, M.; Mosora, F. (Univ. Liege, Sart Tilman, Belgium). pp 343-358 of Isotope Ratios as Pollutant Source and Behaviour Indicators. Vienna; International Atomic Energy Agency (1975). (In French)

From symposium on isotope ratios as pollutant source and behavior indicators; Vienna, Austria (18 Nov 1974). See STI/PUB-382; CONF-741120-.

Following the work undertaken by Duchesne et al., a synthesis of the results obtained since 1968 is presented. Differences up to 10 percent are observed in the isotopic ratio $^{13}C/^{12}C$ of the CO_2 exhaled by various animals as a function of their diet and especially of the presence in their diet of vegetables characterized by a C4 photosynthetic pathway (such as maize). Weak but significant variations of the CO_2 isotopic ratio are also observed during starvation, after injection of hormones which regulate the glycaemia or even simply in relation to the metabolic rhythms of normal digestion; these variations seem to be correlated with the modifications arising in the relative proportion of substrates from which carbon dioxide is formed. Small isotopic fractionations, appearing mainly in bones and fats, were also shown by combustion of various tissues. Moreover, a change in diet (use of corn) affects clearly, not only the exhaled CO_2, but also, within a few days, the mean ^{13}C content of organs, mainly in the case of the liver. These metabolic fractionations remain, however, limited enough to use the ^{13}C content, naturally a little higher, of C4 photosynthetic vegetables as a tracer in order to follow some metabolic processes. An application of this is presented by way of a glucose tolerance test. (auth)

7656 INDIUM-113m PERFUSION STUDY AND THE NONFUNCTIONING THYROID NODULE. Shih, W. J. (Tri-Service General Hospital, Taipei, Taiwan). J. Nucl. Med.; 16: No. 12, 1187-1188(Dec 1975).

Indium-113m eluate has been used to study the perfusion of 12 patients with solitary thyroid nodules that appeared cold in the ^{131}I and /sup 99m/Tc image studies. Seven patients with colloid nodules showed no perfusion and the remaining five (three adenomas and two carcinomas) showed good perfusion with indium. Histologic confirmation was obtained in all cases. Indium-113m perfusion study may be useful in differentiating colloid nodules from either adenomas or carcinomas. (auth)

7657 DIAGNOSTIC VALUE OF RENAL IMAGING INCIDENTAL TO BONE SCINTIGRAPHY WITH /sup 99m/Tc-PHOSPHATE COMPOUNDS. Vieras, F.; Boyd, C. M. (Univ. of Arkansas, Little Rock). J. Nucl. Med.; 16: No. 12, 1109-1114 (Dec 1975).

An assessment of the sensitivity and reliability of renal images obtained incidentally to bone scintigraphy with /sup 99m/Tc-phosphate compounds is reported, and certain patterns of abnormalities associated with those renal images are described. Renal images in 119 bone scintigrams were reviewed and correlated retrospectively with radiographic procedures done within 2 weeks of the bone images. The detection rate for renal abnormalities was 97.4 percent; the false-positive rate was 8.6 percent and the false-negative rate was 2.6 percent. Abnormal renal images were categorized as (a) nonvisualization of one kidney (13 cases), (b) asymmetric uptake (11 cases), (c) focal decreased uptake (4 cases), (d) bilateral decreased uptake (6 cases), (e) focal increased uptake (4 cases), and (f) miscellaneous (6 cases). The first three categories were always associated with renal abnormalities. Bilaterally decreased uptake and focal increased uptake were not reliable in detecting disease. Extensive metastatic carcinoma of the prostate was noted in three of four patients with bilateral decreased uptake and normal intravenous pyelography. We conclude that renal imaging incidental to bone scintigraphy with phosphate compounds is a valuable diagnostic test. An understanding of the different patterns of abnormalities described should improve the overall reliability of the test. (auth)

7658 COMPREHENSIVE EVALUATION OF RENAL FUNCTION IN THE TRANSPLANTED KIDNEY. Dubovsky, E. V.; Logic, J. R.; Diethelm, A. M.; Balch, C. M.; Tauxe, W. N. (Univ. of Alabama, Birmingham). J. Nucl. Med.; 16: No. 12, 1115-1120 (Dec 1975).

By means of a comprehensive renal function test based on the analysis of orthoiodohippurate kinetics carried out 223 times in 86 renal transplant patients, we have been able to separate clearly five clinical entities: normally functioning transplanted kidneys, acute tubular necrosis, cell-mediated rejection, humoral (chronic) rejection, and postrenal obstruction. Accurate prediction of the fate of the rejecting kidney can be made while still subclinical as much as a week before manifestations by other techniques are evident. Data on 22 donors studied 44 times are also presented. The comprehensive test consists of measurements of effective renal plasma flow (ERPF), sequential scintigraphy, calculations of excretory index (EI) (percent dose actually found in bladder and voided urine as a fraction of the percent dose expected at a given time after injection at the patient's specific ERPF), and residual urine volume. Formulas and regression equations for the calculation of ERPF, EI, residual urine, etc., are presented. (auth)

7659 INCREASED /sup 99m/Tc-POLYPHOSPHATE MUSCLE UPTAKE IN A PATIENT WITH POLYMOSITIS: CASE REPORT. Spies, S. M.; Swift, T. R.; Brown, M. (Medical Coll. of Georgia, Augusta). J. Nucl. Med.; 16: No. 12, 1125-1127 (Dec 1975).

A patient with well-documented rheumatoid arthritis and polymyositis displayed abnormal muscle uptake of /sup 99m/Tc-polyphosphate during routine bone scanning for occult malignancy. The regions of increased uptake corresponded to the areas of clinically active inflammatory muscle disease. On serial scans the degree of muscle labeling correlated well with both clinical and laboratory indices of disease activity. (auth)

7660 LIVER-SPLEEN SCINTISCAN IN KALA-AZAR: CASE REPORT. Moniot, A. L. (National Naval Medical Center, Bethesda, MD). J. Nucl. Med.; 16: No. 12, 1128-1129(Dec 1975).

Massive splenomegaly was found in a liver-spleen scan in a young man from Greece. Kala-azar was suggested as a possible cause and was confirmed by culturing Leishmania donovani from the bone marrow aspirate. The differential diagnosis of massive splenomegaly should include kala-azar when a patient has been in an endemic area. (auth)

7661 TECHNETIUM-99m-SULFUR COLLOID AND PERTECHNETATE BLOOD POOL SCANS IN HEPATIC VENO-OCCLUSIVE DISEASE: CASE REPORT. Fitzer, P. M. (Riverside Hospital, Newport News, VA). J. Nucl. Med.; 16: No. 12, 1130-1131(Dec 1975).

A liver scan on a patient with biopsy-proven hepatic veno-occlusive disease showed multiple areas of decreased sulfur colloid uptake which were not perfused on the blood pool phase of a pertechnetate bolus study. (auth)

7662 IDENTIFICATION OF AN INFECTED PSEUDOCYST OF THE PANCREAS WITH ^{67}Ga-CITRATE: CASE REPORT. Kennedy, T. D.; Martin, N. L.; Robinson, R. G.; Preston, D. F. (Kansas Univ. Medical Center, Kansas City). J. Nucl. Med.; 16: No. 12, 1132-1134(Dec 1975).

A case in which the preoperative diagnosis of an infected pseudocyst of the pancreas was made by ^{67}Ga-citrate scanning is reported. Other approaches to the diagnosis of pancreatic pseudocysts are reviewed. (auth)

7663 ACCESSORY THYROID IN THE ANTERIOR MEDIASTINUM: CASE REPORT. Salvatore, M.; Gallo, A. (Fondazione Senatore Pascale Tumor Inst., Naples). J. Nucl. Med.; 16: No. 12, 1135-1136(Dec 1975).

A case of accessory thyroid in the anterior mediastinum, physically separated from the thyroid gland, is reported. The mediastinal thyroid was incidentally discovered during the preoperative evaluation of a patient with breast carcinoma. The extreme rarity of the case is outlined. (auth)

7664 TECHNETIUM-99m-LABELED STANNOUS IMIDODIPHOSPHATE: A NEW RADIODIAGNOSTIC AGENT FOR BONE SCANNING: COMPARISON WITH OTHER /sup 99m/Tc COMPLEXES. Subramanian, G.; McAfee, J. G.; Blair, R. J.; Rosenstreich, M.; Coco, M.; Duxbury, C. E. (Upstate Medical Center, Syracuse, NY). J. Nucl. Med.; 16: No. 12, 1137-1143(Dec 1975).

Imidodiphosphate (IDP) is an analog of pyrophosphate and diphosphonate, with a P-N-P bond instead of P-O-P or P-C-P. We have labeled IDP with /sup 99m/Tc quantitatively (98 per cent) using stannous ions as the reducing/complexing agent in a freeze-dried kit form. Radiobioassay of this compound was carried out in rabbits and the results were compared with those of eight other Tc-labeled bone-imaging agents, using the performance of simultaneously administered ^{85}Sr as a reference standard. The /sup 99m/Tc-IDP concentrated 20 percent higher in the bone, and its soft-tissue and blood levels were lower than with ^{85}Sr. By comparison, the concentrations in the bone of the other /sup 99m/Tc agents were 20 percent less than that of ^{85}Sr. Regarding blood levels, Tc-IDP performed worse than the Tc-diphosphonate but better than the pyrophosphate and the other technetium complexes. Scintillation camera images of /sup 99m/Tc-IDP in both rabbits and dogs showed excellent details of the skeleton. In a preliminary human study, images with /sup 99m/Tc-IDP were somewhat inferior to those comparably procured with /sup 99m/Tc-methylene diphosphonate, but count rates with the IDP complex were about twice those with the MDP compound. Because of its better bone uptake, however, it is suggested that /sup 99m/Tc-IDP may be clinically useful in spite of its relatively slow blood clearance. (auth)

7665 TIME COURSE OF /sup 99m/Tc(Sn)-TETRACYCLINE UPTAKE IN EXPERIMENTAL ACUTE MYOCARDIAL INFARCTION. Holman, B. L.; Zweiman, F. G. (Harvard Medical School, Boston). J. Nucl. Med.; 16: No. 12, 1144-1146(Dec 1975).

The relative concentration of /sup 99m/Tc(Sn)-tetracycline in infarcted myocardium was determined as a function of time after coronary artery occlusion in mongrel dogs. The concentration ratio (infarct-to-normal myocardium) was highest within the first 2 days after occlusion (6.7 +- 0.5 at 1 day and 8.0 +- 1.6 at 2 days). By 1 week after occlusion the ratio had fallen to 1.9 +- 0.2. In the region of infarction, the concentration of /sup 99m/Tc(Sn)-tetracycline was homogeneously distributed across the inner three-quarters of the myocardial wall; the outer quarter of the wall had substantially lower concentrations during the first 5 days after infarction. The present study confirms the observation suggested in initial investigations in man that scintigraphy performed with /sup 99m/Tc(Sn)-tetracycline will distinguish between acute and chronic myocardial infarctions. (auth)

7666 DOSIMETRY OF SEVERAL DTPA RADIOPHARMACEUTICALS IN CISTERNOGRAPHY. Brookeman, V. A.; Morin, R. L. (Univ. of Florida, Gainesville). J. Nucl. Med.; 16: No. 12, 1177-1182(Dec 1975).

Previously published biologic distribution and clearance data for ^{169}Yb-DTPA in cisternography were utilized to obtain effective spinal segment clearance data for six other easily chelated radionuclides: /sup 99m/Tc, /sup 113m/In, ^{111}In, ^{67}Ga, ^{51}Cr, and ^{203}Pb. Absorbed radiation doses to the spinal cord and nerve roots were calculated for each radioactive DTPA compound, employing appropriate cylindrical geometry and reduction coefficients for the dose contributions from the electrons of each radionuclide. Doses are maximal at the surface and decrease rapidly with distance from the surface. The relative useful photon flux from each DTPA radiopharmaceutical for approximately the same average absorbed radiation dose to the spinal cord was determined. The results indicate that ^{111}In and ^{203}Pb should be considered as possible radionuclide tags for DTPA cisternographic imaging. (auth)

7667 DEVELOPMENTS IN DIGITAL COMPUTER IMPLEMENTATION IN NUCLEAR MEDICINE IMAGING. Budinger, T. F. (Univ. of California, Berkeley); Harpootlian, J. Comput. Biomed. Res.; 8: 26-52(1975).

The usefulness of a digital computer system for acquisition, manipulation and display of nuclear medicine or other medical two-dimensional images is enhanced by fast data acquisition of 80,000 cps in list mode (128 x 128) and 300,000 cps in histogram mode (64 x 64) with 3 mu sec pulse pair resolution and dual isotope handling capabilities. Speed and ease of operation are important developments which lead to practical clinical application of research developments such as brain and heart blood-flow studies, Fresnel hologram reconstruction, three-dimensional reconstruction from multiple camera views, and display of functional images such as lung, heart, and kidney uptake and clearance rates. (auth)

7668 RADIOIMMUNOASSAY OF THE MAJOR GROUP SPECIFIC PROTEIN OF ENDOGENOUS BABOON TYPE C VIRUSES: RELATION TO THE RD-114/CCC GROUP AND DETECTION OF ANTIGEN IN NORMAL BABOON TISSUES. Sherr, C. J.; Todaro, G. J. (National Cancer Inst., Bethesda, MD). Virology; 61: No. 1, 168-181(Sep 1974).

The major group specific (gs) protein of the endogenous baboon type C virus M7 was purified to homogeneity by gel filtration and isoelectric focusing. The protein has a molecular weight of approximately 33,000, as determined by electrophoresis in polyacrylamide gels containing sodium dodecyl sulfate, and an isoelectric point (pI) of 7.1, different from the pIs of similarly purified gs proteins from six other mammalian type C viruses. Detergent disrupted M7 virus, whether grown in canine thymus or human rhabdomyosarcoma cells, fully displaced radiolabeled M7 gs protein from antigen-antibody complexes in a competitive radioimmunoassay. No antigenic differences were detected among the gs proteins of five independent isolates of baboon type C viruses grown in various cultured cell lines. The gs proteins of six independently isolated feline viruses of the RD-114/CCC group were antigenically related to, but could be distinguished from, the gs proteins of baboon type C viruses. No significant cross-reactions were observed in the radioimmunoassay for M7 gs protein using several other type C viruses, including two previously isolated from a woolly monkey and a gibbon ape. Group specific antigen was found in normal baboon testicular and splenic tissues using the M7 radioimmunoassay; no gs antigen could be detected in these same tissues using a radioimmunoassay for the gs protein of the woolly monkey type C virus. No gs antigen was found in baboon liver or in the tissues of several other primates. (auth)

7669 DETECTION OF ELEMENTS IN THE LUMEN AND THE FOLLICLE CELLS OF THE THYROID GLAND OF THE HORSE BY X-RAY MICROANALYSIS. Makita, T.; Kiwaki, S. (Yamaguchi Univ., Japan). Nippon Soshikigaku Kiroku; 37: No. 2, 143-148 (Sep 1974).

The follicle epithelial cells of the thyroid gland from three horses were subjected to x-ray microanalysis to identify directly the distribution of iodine and other elements. The scanning transmission electron micrograph of the thyroid was directly correlated with the distribution of these elements detected by energy dispersive x-ray microanalyzer. Higher level of I, S, P, and Cl was detected in the intracellular granules while the luminal substance contained less I, S, Cl and little, if any, P. Data presented here might be evidence to support the condensing process of iodine in the follicle being absorbed into the intracellular droplet and then be concentrated further in the lysosomal granules. (auth)

7670 RADIATSIONNAYA MEDITSINA. (Radiation Medicine. Proceedings of a Conference Held October 7-15, 1968, at Minsk, USSR). Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). 448p. (CONF-681061-P3).

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The papers presented at the session on "Radiation Medicine" are compiled. They deal with the use of new methods and with the construction of equipment, dosimetry, and radiation hygeine. New trends in radiation and radioisotopic diagnostics in internal medicine, oncology, neurosurgery, endocrinology, and ophthalmology are discussed. Radiation therapy and questions on the development and manufacture of unified gamma therapeutic devices and dosimetric apparatus. Calculations of dose fields and absorbed dose are also considered. Special attention is given to the area of radiation sterilization and radiation hygeine. Separate abstracts were prepared for each article. (JSR)

For abstracts of individual papers see: 6902, 6903, 7357, 7369, 7370, 7377-7379, 7411, 7426, 7451-7462, 7485-7505, 7539, 7569, 7580-7589, 7595, 7602, 7620-7622, 7671-7700, 7932-7934, 8594-8598, and 8600-8602.

7671 CLINICAL RADIOISOTOPIC DIAGNOSTICS FOR 20 YEARS. Agranat, V. Z. pp 5-8 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A brief review is given of the primary results obtained in the use of radioisotopic diagnosis and the prospects for its ever-widening use. The growth of these techniques is based on the availability of pharmacological radioactive substances, develop-

ment of special medical radiodiagnostic devices, and the standardization of these devices and improvement of their sensitivity. Factors affecting future development of these techniques are reviewed. (JSR)

7672 USE OF RADIOACTIVE ISOTOPES FOR DIAGNOSTIC PURPOSES. Modestov, V. K. pp 9-13 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The diagnostic uses of radioisotopes can be divided into three sections: for the detection of malignant neoplasms, for the study of cardio-vascular pathology, and for the determination of the functional capacity of organs and tissues. A brief summary is given of the developments made in each of these areas and the primary isotopes used. (JSR)

7673 RADIOACTIVE ISOTOPE ^{32}P IN THE DETERMINATION OF THE LOCATION OF INTRACEREBRAL VOLUME EVOLUTION. Snigirev, V. S.; Desyatnikov, V. M. pp 13-17 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The use of ^{32}P for the determination of the site and defining more precisely the boundaries of brain tumors is discussed. The results obtained on 188 patients injected with ^{32}P 45 to 60 minutes before surgery showed that this method gives substantial help to the neurosurgeon in the detection of the total pathological formation and in the determination of the prevalence and complete removal of these formations. (JSR)

7674 PREFERENCE IN THE USE OF ^{133}Xe IN γ MYELOGRAPHY. Lyass, F. M. pp 17-21 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

An analysis of clinical tests made over a period of 10 years showed that γ myelography with ^{133}Xe has a decisive diagnostic value over other isotopes with respect to the information obtained and the radiation burden to the patient. It is a valuable supplementary test in the complex determination of neurosurgical illness. (JSR)

7675 RADIOISOTOPIC DIAGNOSTICS IN OTORHINOLARYNGOLOGIC ONCOLOGY. Aronskii, A. I. pp 21-23 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat(1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The clinical results of the use of ^{32}P in the diagnosis of otorhinolaryngologic tumors are reported. They indicate that this is a valuable supplementary method and can be used in conjunction with other methods. The special usefulness of the method is in those cases where biospy and cytological studies were contraindicative. The relative accumulation of ^{32}P was the criterion of malignancy as the degree of accumulation depends on the stage of malignancy. This method can also be used as a control of the effectiveness of radiation therapy or surgery. (JSR)

7676 ^{85}Sr IN THE DIAGNOSIS OF TUMORS OF THE BONE SYSTEM. Zarkevich, N. F.; Mechev, D. S.; Kindzel'skii, L. P.; Tolstopyatov, B. A. pp 23-28 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Results obtained in the study of the use of ^{85}Sr in the diagnosis of bone tumors showed the high osteotropism of this isotope. Preparations of ^{85}Sr in diagnostic doses are not toxic and do not cause reduction of hemopoiesis. At the site of the bone tumor the accumulation of ^{85}Sr is very pronounced in comparison with healthy bone tissue. The accumulation of ^{85}Sr in malignant bone tumors significantly exceeds its accmulation in benign tumors. The dependence of the level of accumulation of the isotope on the character of the tumor can be a valuable factor in differential diagnosis. (tr-auth)

7677 EXPERIMENTAL EVALUATION OF SOME RADIOACTIVE PREPARATIONS FOR THE DIAGNOSIS OF SKELETON DISEASES. Sedov, V. V.; Sorokin, V. P. pp 28-33 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A comparative study was made on mice of the values of ^{85}Sr, ^{87m}Sr, ^{67}Ga, ^{111}In, and ^{135m}Ba in the diagnosis of bone diseases. The accumulation of ^{85}Sr was strikingly different in healthy and diseased bone tissue. No toxic or pathological effects induced by the radioisotope were observed. Analogous studies with the other isotopes showed that they were preferentially concentrated in the bone tissue but the Sr isotopes were deposited in much larger quantities in the bones than the other isotopes. There was sufficient accumulation of the ^{87m}Sr in muscle tissue to cause significant difficulties in diagnosis. (JSR)

7678 EXPERIMENTAL STUDY OF NEW COLLOIDAL PREPARATIONS WITH ^{99m}Tc FOR RADIOISOTOPIC DIAGNOSIS. Tarasov, N. F.; Koval'chuk, N. D.; Mikheev, N. B.; Mikheeva, L. M.; Titkova, T. D. pp 33-37 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The methods for the preparation of three colloidal preparations of ^{99m}Tc-labelled compounds—yttrium melanoidinate, tin hydroxide, and albumin colloidal solution—were described and the results of liver and bone scans on rabbits and dogs with these preparations were reported. The biological half life of each preparation and its biological behavior was determined. The albumin preparation and the tin hydroxide were preferable for liver scanning. The colloidal albumin preparation at a pH of 4.5 appeared to fulfill more completely the requirements for bone marrow scans. (JSR)

7679 USE OF RADIOISOTOPIC METHODS DURING THE STUDY OF THE DISTRIBUTION AND ELIMINATION OF ANTITUMORAL AGENTS (^{14}C-AURANTINE AND ^{32}P-DIPINE) IN ANIMALS. Suskova, V. S.; Serebryakov, N. G.; Chernov, V. A. pp 37-40 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The distribution of ^{14}C-aurantine in the liver, spleen, and tumors and the rate of its elimination from the body was studied in mice. The distribution of ^{32}P-dipine in the blood, liver, kidneys, spleen, and tumors and the rate of its elimination were studied in the rat. The distribution of aurantine was followed for 18 hrs and that of dipine for 24 hrs. The results are tabulated. An evaluation of these results show that the use of labelled compounds made it possible to study the characteristics of these compounds in the organism, the concentration in the tumor, and the method and rate of their elimination after administration of a therapeutic dose. (JSR)

7680 RADIOISOTOPIC DETECTION OF FUNCTIONAL DISTURBANCES IN ONCOLOGICAL PATIENTS. Sukovatykh, L. S.; Nisenbaum, L. I.; Shitikov, B. D.; Stankevich, M. P. pp 40-43 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The results obtained at the Scientific Research Institute of Oncology and Medical Radiology of Belorussian SSR in the use of radioisotopes, particularly ^{131}I, ^{197}Hg, and ^{203}Hg, in functional studies and renographic studies are briefly summarized. It is shown that radioisotopic methods play a significant role not only in the detection of tumors and the determination of their character, location, and dimensions, but give substantial data in a series of cases in the functional state of individual organs and systems. (JSR)

7681 USE OF COMPUTERS IN THE RADIOISOTOPIC DIAGNOSIS OF TUMORS. Serebryanyi, E. G.; Tarasov, V. M.; Timoshchenko, V. P. pp 44-46 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

From phantom data and from actual scans of livers with cancer metastases a computer program was developed for the processing of scanograms. Its development is briefly described. (JSR)

7682 RADIOISOTOPIC DIAGNOSTICS IN NON-ONCOLOGICAL PRACTICE. Fateeva, M. N. pp 46-51 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Individual examples are given of the use of radioisotopes in the diagnosis of illnesses other than cancers. The examples given include heart functional diagnosis, blood dynamic studies, lung functional studies, liver scans, study of the gastro-intestinal tract, thyroid diagnosis, and the examination of the vascular system. (JSR)

7683 TESTS ON THE USE OF SOVIET RADIODIAGNOSTIC DEVICES IN CLINICAL STUDIES. Sivachenko, T. P.; Slavnov, V. N.; Oderii, S. N.; Tsvetkova, V. V.; Kalina, V. K.; Ishchenko, V. P.; Kapustnik, V. I.; Valueva, G. V.; Pekur, V. G. pp 51-60 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The sensitivity, reliability, and reproducibility of a number of radiodiagnostic devices of Soviet manufacture were tested. Typical radioactivity curves and scanograms obtained with them are given. The URU-64 was designed to determine the functional state of different organs and systems under dynamic conditions. The "Ksenon" was used for the determination of local ventilation and blood supply to the lungs. For differential diagnosis of neoplasms the β-probe radiometer "Kometa" was designed. γ topographic devices and scintillation counters were also studied and typical results obtained with them are shown. (JSR)

7684 USE OF RADIOISOTOPES IN CARDIOVASCULAR SURGERY. Malov, G. A. pp 60-63 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The uses of radioisotopes in the determination of the rate of blood flow at different parts of the cardiovascular system, pulsating ejections, volume of circulating blood, and blood supply to the lungs are among the applications considered. Each of these is examined individually. (JSR)

7685 RADIOISOTOPIC RENOGRAPHY WITH ^{131}I-HIPPURAN IN INTERNAL MEDICINE. Tsfasman, A. Z.; Davitinidze, N. L.; Rutshtein, L. G.; Tslaf, Z. Z.; Granovskaya-Tsvetkova, A. M. pp 63-67 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (oct 1968). See CONF-681061-P3.

Results obtained with ^{131}I-hippuran in the study of kidney function in patients with nephritis, Itsenko-Kushinga disease in comparison with hypertonic illnesses, sugar diabetes, systemic and discoid lupus, systemic and limited scleroderma, dermatomyositis, and vasculitis are reported and compared with results obtained by other methods. (JSR)

7686 RADIOACTIVE ^{133}Xe IN STUDIES OF LUNG FUNCTION. Korsunskii, V. N. pp 67-71 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The principles of lung function studies using ^{133}Xe are briefly outlined. Results obtained in studies on patients with lung cancer, tuberculosis, and chronic inflammations in the lungs were outlined to illustrate the value of the method. (JSR)

7687 USE OF RADIOISOTOPIC RENOGRAPHY IN AMBULATORY PRACTICE. Frenkel, V. Kh.; Katsyf, A. M.; Mil'man, N. Ya. pp 71-75 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The usefullness of ^{131}I-hippuran in the initial scanning of patients with possible kidney malfunctions and hypertension and in the dynamic observation of the functional state of the kidneys was evaluated on the basis of 1523 renographs made on an out-patient basis. The results obtained are tabulated. The wide use of this method is limited by the availability of necessary apparatus and personnel. (JSR)

7688 RADIOACTIVE CHROMIUM (^{51}Cr) IN THE DETERMINATION OF GASTROENTERITIC BLOOD LOSS. Tsfasman, A. Z.; Dibizheva, G. V: Sadulaev, L. Sh. pp 75-78 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The principle of the method of using ^{51}Cr for the determination of blood loss is outlined. Tests on 1342 patients have shown that it is a specific and highly sensitive method. The results obtained in various illnesses are tabulated to illustrate this. (JSR)

7689 TEST ON THE USE OF TRITIUM FOR DETERMINATION OF WATER EXCHANGE IN EXPERIMENTS DURING SURGERY. Bogdanova, K. M.; Romanovskaya, L. I.; Maklakov, N. I. pp 78-81 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Animal experiments on dogs under narcosis and under narcosis with surgery showed that the water exchange in all periods of narcosis was different from that of the controls. During lobectomy the dynamics of water exchange was characterized by very long periods of equilibrium distribution and very short periods of release of tritium from the organism. On the basis of a mathematical interpretation of the graphic representations of the dynamics of water exchange it is possible to evaluate quantitatively the degree of disturbance to the water exchange. (tr-auth)

7690 CLINICAL USE OF WHOLE-BODY COUNTING FOR STUDY OF IODINE EXCHANGE. Matveenko, E. G. pp 86-89 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Clinical evaluation of whole-body counting for the study of iodine exchange showed that extended study is possible after a single introduction of the isotope. All stages of the exchange, including the metabolism of thyroxine in the tissues, can be followed. The inorganic phase of ^{131}I can be followed, and data can be obtained on the rate of the exchange process in the tissues. Both the qualitative and quantitative characteristics of the exchange process can be followed in the same organ. With whole-body counting the dose administered can be significantly reduced. (JSR)

7691 PRINCIPLES OF THE STUDY OF IODINE EXCHANGE BY THE METHOD OF WHOLE-BODY COUNTING. Palinkashi, D. G. pp 89-92 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A whole-body counting method, based on the shielding of the region of the thyroid gland, was developed to fix the release of iodine from the organism and to determine its distribution. The distribution was the determining factor in the determination of the concentration of organic iodine in the body. In the kidney under conditions of normal secretory function there is practically no inorganic iodine and the radioactivity of the organ, even three hours after introduction of the radioisotope, is caused by iodine of organic origin. Clinical observations made with this method showed that it can be used to obtain data on the basic phases of iodine exchange and on the dynamics of its indicators. (JSR)

7692 RADIOISOTOPIC RENOMETRY USING ^{203}Hg-NEOHYDRIN. Tsomyk, V. G.; Kotlyarov, E. V. pp 92-95 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The reasons for the precision of the results of radioisotopic renometry using ^{203}Hg-neohydrin and a monocrystal counter for whole-body counting were given. The results of the investigation of 20 healthy persons and 96 patients having basic urological illness were analyzed. The first results obtained in the use of a collimated scintillation counter centered in the region of the kidneys were reported. The procedure used is outlined. (JSR)

7693 USE OF LARGE COUNTERS AND THE METHOD OF RADIOACTIVE TRACERS FOR THE INVESTIGATION OF THE METABOLISM OF SOME BIOELEMENTS IN THE NORMAL PERSON AND IN PATHOLOGICAL CONDITIONS. Shapiro, E. L.; Shcherba, M. M.; Krasnoshchekova, G. P.; Likhtarev, I. A.; Smirnov, B. I.; Pokrovskaya, D. V.; Shamov, V. P.; Kazan, A. G. pp 96-99 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Results obtained in the clinical use of large γ spectrometers and large liquid scintillation 4π counters in the diagnosis of such illness as muscular dystrophy, K–Na insufficiency, and breakdown

of kidney function were summarized. The isotopes used were the water-salt exchange alkali elements ^{42}K, ^{22}Na, ^{24}Na, ^{132}Cs, ^{134}Cs, and ^{86}Rb; the alkaline earth metals ^{28}Mg, ^{47}Ca, ^{85}Sr, and ^{140}Ba; and the organotropic isotopes ^{131}I, ^{132}I, and ^{65}Zn. The metabolic constants obtained for several elements in healthy persons were reported. (JSR)

7694 NEW METHODS AND NEW RADIOACTIVE PREPARATIONS FOR SCANNING INTERNAL ORGANS. Turaev, R. N.; Baichorov, E. O.; Kulikova, M. M.; Kuzentsov, N. S.; Ispenkov, E. A. pp 312-317 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Among the new methods and radiopreparations discussed are the automatic processing of scanning data for a quantitative evaluation of the scannogram, the use of aerosols and macroaggregates labelled with ^{131}I or ^{198}Au, and the use of ^{99m}Tc compounds for scanning the heart and spleen. Examples of each of these are given and briefly discussed. (JSR)

7695 RADIOTRACER STUDY OF TISSUE BLOOD CIRCULATION DURING THE OBLITERATING ENDARTERITIS. Shishkin, V. P.; Kaperko, F. F.; Chunyaev, V. M. pp 317-319 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The use of solutions of Na ^{131}I in the diagnosis of obliterating endarteritis was investigated. The time for the resorption of the labelled compound corresponded closely with clinical and laboratory evaluation of the stage of illness. (JSR)

7696 DETERMINATION OF THE AVERAGE ABSORBED DOSE IN THE HUMAN BODY DURING DIAGNOSIS WITH LABELLED COMPOUNDS IN WHOLE-BODY COUNTERS. Sereda, M. G. pp 319-322 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The use of a whole-body counter for the measurement of the absorbed dose was studied. The principle of its use was the difference in the energy spectrum of γ radiation in the presence and absence of absorbers. The difference was the indication of the absorbed dose. The method for the data processing was described and experimental results obtained with ^{131}I and ^{59}Fe were reported. (JSR)

7697 ISOTOPE CIRCULOGRAPH DURING ANEURISMS OF VESSELS OF THE BRAIN. Modestov, V. K.; Shakhnovich, R. A.; Boeva, E. M.; Kaperko, F. F.; Grishina, L. P. pp 323-325 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Radioiodine serum albumin was used to measure the blood circulatory time in 80 patients with aneurisms of the brain. Both the arterial and venous phase of the brain blood flow as well as the total circulation time could be determined. (JSR)

7698 CLINICAL POSSIBILITY FOR THE RADIOISOTOPIC DIAGNOSIS OF TUMORS. Shevchenko, I. T.; Khripta, F. P. pp 325-328 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The results of studies made on more than 1400 patients in the use of isotopes for the diagnosis of tumors at different sites are reported. Radioisotopic methods were used not only for the determination of the functional impairment of an organ and the differential diagnosis of primary tumors but for the establishment of the stage of tumorization, the biological activity of the tumor, its extent, and determination of relapses and metastases in adjacent and individual organs and tissues. Radioisotopic methods were also used to measure the effectiveness of the therapy carried out. (JSR)

7699 DIAGNOSTIC USE OF RADIOACTIVE COMPOUNDS IN DISEASES OF THE THYROID GLAND. Mirkhodzhaev, A. Kh. pp 328-332 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

Data are presented for more than 700 patients with thyroid glands in various states of health and impairment. These data show that a very precise analysis of the state of thyroid function can be obtained on the basis of the absorption of radioiodine by the thyroid gland. (JSR)

7700 SCANNING ON A γ TOPOGRAPH WITH A GRAPHIC DISPLAY SYSTEM. Sivachenko, T. P.; Slavnov, V. N.; Kapustnik, V. I.; Ishchenko, V. P.; Valueva, G. V.; Oberemko, B. I.; Udovik, M. A.; Grishko, E. N. pp 373-381 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The methods used with the γ topograph GT-60 for scanning diseased liver, kidneys, thyroid gland, spleen, and brain with ^{131}I, ^{132}I, ^{198}Au, ^{131}I-rose bengal, and ^{203}Hg- and ^{197}Hg-neohydrin are discussed. Examples are given of the graphic displays obtained. The device is suitable for clinical use. (JSR)

7701 IN VIVO HUMAN PHARMACODYNAMICS OF THE PSYCHODYSLEPTIC 4-Br-2,5-DIMETHOXYPHENYLISOPROPYLAMINE LABELLED WITH ^{82}Br OR ^{77}Br. Sargent, T.; Kalbhen, D. A.; Shulgin, A. T.; Braun, G.; Staufer, H.; Kusubov, N. (Univ. of California, Berkeley). Neuropharmacology; 14: 165-174(1974).

The psychodysleptic compound 4-Br-2,5-dimethoxyphenylisopropylamine (4-Br-DPIA) was synthesized with ^{82}Br or ^{77}Br and administered to five human subjects in three oral and three intravenous experiments. In vivo organ concentrations were measured by gamma ray scintigraphy with computerized area integration, and by whole-body counting. Urine was analyzed by solvent separation, and thin layer chromatography of dansylated metabolites. The urine contained less than 5 percent radiobromine precipitate by acidic $AgNO_3$, demonstrating that the Br label remained organically bound. Upon intravenous administration radioactivity appeared immediately in the lungs by first-pass extraction, was rapidly released and reached maximum concentrations in the liver at 0.5 to 1.5 hr, plasma at 2 to 3 hr and brain at 3 to 6 hr. Orally the pattern was the same except that the initial lung concentration did not occur. This sequence of maximum organ concentrations suggests that a metabolite of 4-Br-DPIA is the centrally active compound which concentrates in the brain. Solvent separation of urine showed 81.8 percent of metabolites to be aqueous soluble and 12.5 percent free base; slower whole-body excretion correlated with higher levels of free base in the urine. The methods used demonstrate a new approach to the study of in vivo distribution and kinetics of drugs which can be labelled with gamma-emitting radioisotopes. (auth)

7702 FAILURE OF ^{111}In-LABELED BLEOMYCIN TUMOR SCANNING TO PREDICT RESPONSE TO BLEOMYCIN (NSC-125066) TREATMENT. Jones, S. E.; Salmon, S. E.; Durie, B. G. M. (Univ. of Arizona, Tucson). Cancer Chemother. Rep.; 58: No. 5, 733-735(1974).

The question of whether or not ^{111}In-labeled bleomycin is predictive of the response of tumors to bleomycin treatment is answered in the negative. The real test of the value of labeled bleomycin as a predictor of response will be possible only when a tightly labeled bleomycin with fully preserved biologic activity is synthesized. The negative results of this study do not invalidate further investigations of the predictive values of labeled anticancer drugs. (ERB)

7703 COMBINED THERMOGRAPHY AND ISOTOPE SCANNING IN THYROID PATHOLOGY. Galli, G.; Salvo, D.; Troncone, L.; de Rossi, G. (Univ. Cattolica del Sacro Cuore, Rome). Acta Radiol., Diagn.; 15: No. 6, 656-661(1974).

A Magnatherm Picker apparatus permitting simultaneous thermography and isotope scanning has been used for examination of the thyroid. Thermography was of value in the diagnosis of functional alterations. Hyperthyroidism causes an increase of cutaneous temperature. Combined thermography and isotope scanning appeared useful for investigating non-active thyroid nodules; while malignant tumors tend to increase cutaneous temperature, cysts would give rise to areas of relative hypothermia. An increase in temperature was also seen in ^{131}I active toxic adenomas. (SW)

7704 TECHNICAL IMPROVEMENT IN THE RADIOIMMUNOASSAY OF CYCLIC-AMP. Stragand, J. J.; Hagemann, R. F. (Clinical Radiation Therapy Research Center, Pittsburgh). Experientia; 31: No. 11, 1375-1376(1975).

An improvement in the technique for the radioimmunoassay of cyclic-AMP, wherein ammonium sulfate precipitation is replaced with zirconyl phosphate gel, is presented. This substitution produces a more stable pellet than that obtained with ammonium sulfate. This greatly reduces a potential source of error due to pellet instability. (auth)

7705 DIAGNOSIS OF MALIGNANT TUMORS OF THE MAXILLARY SINUSES AND OF THE NASOPHARYNX BY SCANNING. Prikhodko, A. G.; Gorskii, L. A.; Gabuniya, R. I.; Vorobiev, Yu. I.; Senyukov, M. V. Vestn. Otorino-Laringol.; No. 6, 76-82(1974). (In Russian)

Selenium-75-selenium-methionine was used for the diagnosis of malignant tumors of the maxillary sinuses and the nasopharynx. After an intravenous injection of 200 to 250 μCi of ^{75}Se-selenium-methionine, color scanning of the maxillo-facial region was carried out in two projections; also radiometry of the maxillary sinuses was resorted. A total of 57 patients were investigated. Distribution of selenium-methionine under normal conditions was studied in 20 persons. A positive image of the tumor due to increased accumulation of the selenium-methionine in them was obtained in all the 17 patients with malignant tumors of the maxillary sinuses and in 5 patients with carcinoma of the nasopharynx. Scanning permitted to localize and to ascertain the extent of tumor spread to the adjacent areas with greater precision. Tumor relapses were revealed in 4 patients subjected to radiation or combined treatment before. The therapeutic efficacy was assessed in 5 cases in which scanning was repeated after the termination of a course of radiation therapy. In 15 patients with benign neoplasms in the accessory sinuses (polyps and cysts) accumulation of selenium-methionine was insignificant and results of scanning failed to differ from such in persons without any pathology in the maxillary-facial region. Investigations carried out demonstrated the significance and future prospects of the suggested method for the diagnosis of malignant tumors of the maxillary sinuses and the nasopharynx. (auth)

7706 SOME EXPERIENCE WITH ^{57}Co-LABELED BLEOMYCIN AS A TUMOR-SEEKING AGENT. Rasker, J. J.; van de Poll, M. A. P. C.; Beekhuis, H.; Woldring, M. G.; Nieweg, H. O. (University Hospital, Groningen, Netherlands). J. Nucl. Med.; 16: No. 11, 1058-1069(Nov 1975).

Bleomycin labeled with ^{57}Co was used as a tumor-localizing agent in 132 patients. In patients with pulmonary tumors the primary localization concentrated radioactivity in 52 of the 54 appropriate cases; out of the 22 clinically known metastases, 19 were visible on the scan; 40 unknown metastases especially in hilus and mediastinum were found by this method and subsequently confirmed. In 22 patients with malignant lymphomas, 18 out of 22 known pathologic lymph glands above the diaphragm were visible on the scan; below the diaphragm the results of scanning in lymph glands and spleen were disappointing, probably because of the disturbing concentration of radioactivity in the kidneys, the bladder, the liver, and sometimes the gut. In 25 patients with various other tumors, 16 out of 22 known localizations above the diaphragm were visible; 2 were uncertain and 4 negative. Below the diaphragm the results were usually negative. In 24 patients with benign lesions, uptake of ^{57}Co-bleomycin was visible on the scintigram in 4 patients with cavitating pulmonary tuberculosis, in 2 with pulmonary infections, in 1 with Caplan lesions of rheumatoid arthritis in the lung, and in 1 with sinusitis ethmoidalis. The significance of these results is discussed. (auth)

7707 SELECTIVE UPTAKE OF /sup 99m/Tc COMPLEXES AND ^{67}Ga IN ACUTELY INFARCTED MYOCARDIUM. Zweiman, F. G.; Holman, B. L.; O'Keefe, A.; Idoine, J. (Harvard Medical School, Boston). J. Nucl. Med.; 16: No. 11, 975-979(Nov 1975).

The suitability of various radiopharmaceuticals (/sup 99m/Tc-tetracycline analogs, /sup 99m/Tc-glucoheptonate, /sup 99m/Tc-diphosphonate, and ^{67}Ga-citrate) for use in imaging acute myocardial infarction was assessed by determining their biologic distributions in experimentally infarcted dogs. The highest infarct-to-normal myocardial concentration ratio was found with /sup 99m/Tc-diphosphonate (27.9:1); the highest infarct-to-liver ratio was also found with /sup 99m/Tc-diphosphonate (15.9:1). The infarct-to-bone ratio, however, was 0.4:1 with /sup 99m/Tc-diphosphonate. There was an excellent positive linear correlation between blood-flow reduction and uptake of the radiopharmaceutical after a threshold reduction in blood flow with /sup 99m/Tc-glucoheptonate and /sup 99m/Tc-tetracycline. Technetium-99m-tetracycline accumulated only in infarcted tissue while /sup 99m/Tc-diphosphonate was increased in both ischemic and infarcted tissue. Thus, /sup 99m/Tc-diphosphonate has characteristics best suited for scintigraphic imaging. Since /sup 99m/Tc-tetracycline accumulates only in infarcted tissue, however, this tracer more accurately defines the size of an acute infarction. (auth)

7708 DETECTION AND SIZE ESTIMATION OF ACUTE MYOCARDIAL INFARCTION USING /sup 99m/Tc-GLUCOHEPTONATE. Rossman, D. J.; Rouleau, J.; Strauss, H. W.; Pitt, B. (Johns Hopkins Medical Institute, Baltimore). J. Nucl. Med.; 16: No. 11, 980-985(Nov 1975).

Twenty-seven patients with suspected acute myocardial infarction were studied by precordial scanning after intravenous administration of /sup 99m/Tc-glucoheptonate 2-48 hr after the onset of chest pain. Fifteen of the patients had clinically documented acute myocardial infarctions. Twelve of these 15 (80 percent) had areas of distinctly increased tracer uptake in the region of the heart. The three infarctions not identified by scan had peak serum CPK values of less than 300. In seven patients without infarction, no distinct areas of increased tracer uptake were found in the region of the heart. Five patients could not be classified as to whether infarction had or had not occurred. Three had abnormal scans, the significance of which is uncertain. Infarct size was estimated from the area of increased /sup 99m/Tc-glucoheptonate concentration on scan and compared to peak serum CPK values. A linear correlation with a correlation coefficient of 0.77 was found. Technetium-99m-glucoheptonate scanning was useful for the identification and size estimation of moderate- to large-sized transmural and nontransmural acute myocardial infarctions. (auth)

7709 CORRELATION OF NEOPLASMS WITH INCIDENCE AND LOCALIZATION OF SKELETAL METASTASES: AN ANALYSIS OF 1,355 DIPHOSPHONATE BONE SCANS. Tofe, A. J.; Francis, M. D.; Harvey, W. J. (Procter and Gamble Co., Cincinnati). J. Nucl. Med.; 16: No. 11, 986-989(Nov 1975).

A total of 1,355 patients from clinical trials with the /sup 99m/Tc-labeled bone agent, Osteoscan (/sup 99m/Tc-Sn.EHDP), has shown a higher incidence of skeletal abnormalities than previously reported. Overall in this study, 60 percent of bone scans were abnormal in patients with nonosseous neoplasms. Carcinoma of breast, lung, and prostate yielded 67 percent, 64 percent, and 62 percent skeletal involvement, respectively. Over 50 percent of all the skeletal abnormalities for the neoplastic indications were detected in the thorax and vertebra while the skull, pelvis, and extremities accounted for 22 percent, 38 percent, and 34 percent, respectively. (auth)

7710 EARLY ^{67}Ga SCINTIGRAPHY FOR THE LOCALIZATION OF ABDOMINAL ABSCESSES. Hopkins, G. B.; Kan, M.; Mende, C. W. (Scripps Memorial Hospital, La Jolla, CA). J. Nucl. Med.; 16: No. 11, 990-992(Nov 1975).

Sixty patients suspected of having abdominal abscesses were evaluated by early and delayed ^{67}Ga scintigraphy. The ^{67}Ga scintigraphs obtained 6 hr after injection correctly localized 18 of 20 abdominal or retroperitoneal abscesses. An additional 13 patients with abnormal scintigraphs had clinically established infections. In no instance was an abscess or inflammatory focus present on delayed scintigraphs that was not evident on the 6-hr study. Two false-positive and two false-negative studies were recorded. Early ^{67}Ga scintigraphy is warranted in patients with suspected abdominal abscesses. (auth)

7711 USEFUL, OBJECTIVE CRITERION FOR DETERMINING THE HEALING POTENTIAL OF AN ISCHEMIC ULCER. Siegel, M. E.; Williams, G. M.; Giargiana, F. A.; Wagner, H. N. Jr. (Johns Hopkins Medical Institute, Baltimore). J. Nucl. Med.; 16: No. 11, 993-995(Nov 1975).

Peripheral vascular perfusion studies utilizing intra-arterial injections of /sup 99m/Tc-albumin microspheres were performed on 60 patients who had ischemic ulcers of the lower extremity. Point counting over the lesion and adjacent areas was utilized to qualitate and quantitate the relative hyperemia of the lesion. When this relative hyperemia was at least 3.5:1, approximately 90 percent of the patients had their ulcers healed. In those without this degree of hyperemia only approximately 10 percent eventually had their ulcers healed without surgical intervention. Assessment of relative hyperemia of the ulcer bed is a useful, objective, prognostic indicator of the healing potential of an ischemic ulcer. (auth)

7712 USEFULNESS OF GALLIUM SCINTIGRAPHY IN PRIMARY AND METASTATIC BREAST CARCINOMA. Richman, S. D.; Ingle, J. N.; Levenson, S. M.; Neifeld, J. P.; Tormey, D. C.; Jones, A. E.; Johnson, G. S. (National Inst. of Health and National Cancer Inst., Bethesda, MD). J. Nucl. Med.; 16: No. 11, 996-1001 (Nov 1975).

Gallium-67-citrate whole-body scintigraphy was incorporated into the evaluation of 125 patients with primary and metastatic breast carcinoma. A prospective analysis of these patients demonstrated gallium scanning to be limited in its corroborative value and of practical use only in detecting metastatic breast carcinoma in the mediastinum. Since the extent of tumor involvement is a significant prognostic factor, the gallium scan merits consideration for the detection of mediastinal metastases. (auth)

7713 WIDESPREAD ABNORMALITIES OF RADIOCOLLOID DISTRIBUTION IN PATIENTS WITH MUCOPOLYSACCHARIDOSES. Klingensmith, W. C. III; Eikman, E. A.; Maumenee, I.; Wagner, H. N. Jr. (Johns Hopkins Medical Institute, Baltimore). J. Nucl. Med.; 16: No. 11, 1002-1006(Nov 1975).

Mucopolysaccharidoses (MPS) are inherited disorders of lysosomal enzymes. We have examined the sites of accumulation of intravenously injected /sup 99m/Tc-sulfur colloid in order to assess the regional distribution of phagocytic function in ten patients with MPS: three with Type I (Hurler), five with Type II (Hunter), one with Type III (Sanfilippo), and one with Type VI (Maroteaux-Lamy). Increased lung uptake was observed in 22 of 40 studies (55 percent) on the five patients with MPS Type II but in none of the 38 studies on patients with other MPS types. All MPS patients had diffuse recticuloendothelial (RE) marrow hypoplasia, despite normal or nearly normal hematocrits and hemoglobin levels, suggesting dissociation of the phagocytic and erythropoietic elements of the marrow. The eight patients with MPS Types I and II all had hepatomegaly and increased splenic uptake. Seven of these patients also had splenomegaly. The two patients with MPS Types III and VI did not have hepatosplenomegaly. These studies indicate that the lysosomal enzymic defect of MPS results in widespread abnormalities of the distribution of phagocytic function in the liver, spleen, bone marrow, and probably the lung as well. (auth)

7714 FOCAL PORTA HEPATIS SCINTISCAN DEFECTS: WHAT IS THEIR SIGNIFICANCE. McClelland, R. R. (Univ. of Minnesota, St. Paul). J. Nucl. Med.; 16: No. 11, 1007-1012(Nov 1975).

A total of 537 consecutive liver /sup 99m/Tc-sulfur colloid scintiscans were retrospectively reviewed and 80 of them revealed suspicious focal decreased activity in the region of the porta hepatis. Postmortem, surgical, or biopsy correlation was obtained in 40 of these cases: 14 were pathologically negative; 9, cirrhosis or fibrosis; 10, metastases; 3, dilated bile ducts; 1, viral hepatitis; 1, hepatic laceration; 1, falciform ligament cyst; and 1, ruptured gallbladder with abscessed head of the pancreas. Thus, only 42 percent represented significant disease. Sixty-eight percent of the defects were seen only on the anterior scintiscan. Appearance of the majority of defects was nonspecific. Subjective grading of defects according to size and comparative decrease in density was not beneficial. Elevations of serum alkaline phosphatase, total serum bilirubin, and serum glutamic-oxalacetic transaminase were nonspecific. (auth)

7715 COLD LESIONS ON BONE IMAGING. Sy, W. M.; Westring, D. W.; Weinberger, G. (Brooklyn-Cumberland Medical Center). J. Nucl. Med.; 16: No. 11, 1013-1016(Nov 1975).

Photon-deficient foci or cold lesions were demonstrated on /sup 99m/Tc-polyphosphate bone imaging in eight individuals with various malignancies and one in sickle cell crisis. The bone radiographs of five of these persons failed to show corresponding bony changes at the time of the imaging. Most of the cold lesions observed on bone imaging were located in the denser and tubular bones. A postulate has been advanced regarding the factors that might influence the different gamma-imaging manifestations of radiographically demonstrable lytic lesions. The cases presented herein further emphasize the importance of recognizing the existence of cold areas in the images of bones and the need to place these in proper perspective when interpreting scans. (auth)

7716 ACUTE PULMONARY EMBOLUS ASSOCIATED WITH TRANSIENT VENTILATORY DEFECT: CASE REPORT. Epstein, J.; Taylor, A.; Alazrake, N.; Coel, M. (Veterans Administration Hospital, San Diego, CA). J. Nucl. Med.; 16: No. 11, 1017-1020 (Nov 1975).

In a patient with a clinical history highly suggestive of pulmonary embolism and angiographic evidence also indicative of embolism, the (/sup 99m/Tc-albumin microsphere-^{133}Xe) ventilation/perfusion pattern was that usually observed with parenchymal disease of the lung. The possible basis of this contradiction is discussed. (auth)

7717 ACCUMULATION OF /sup 99m/Tc-POLYPHOSPHATE IN TWO SQUAMOUS CELL CARCINOMAS OF THE LUNG: CASE REPORT. Lowenthal, I. S.; Tow, D. E.; Chang, Y. C. (West Roxbury Veterans Administration Hospital, Boston). J. Nucl. Med.; 16: No. 11, 1021-1023(Nov 1975).

Technetium-99m-polyphosphate was found to accumulate in two squamous cell carcinomas of the lung. In one case, microscopy and electron microscopy failed to demonstrate calcification in the tumor. Possible mechanism(s) of accumulation of polyphosphate in nonosseous tissues was reviewed. (auth)

7718 PRE- AND POSTOPERATIVE MYOCARDIAL AND BLOOD POOL SCANS IN A CASE OF LEFT VENTRICULAR ANEURYSM: CASE REPORT. Rigo, P.; Gach, J.; Mengeot, P. H. (Univ., Liege). J. Nucl. Med.; 16: No. 11, 1024-1026(Nov 1975).

Myocardial perfusion scans (using ^{131}Cs) and blood pool scans (/sup 113m/In) were performed on a patient before and after resection of a left ventricular aneurysm. Although the hugh aneurysm was revealed by preoperative scans, preservation of a significant mass of myocardium was evident. Postoperative scans show the reconstructed heart and the amount of residual damage. The operative findings confirmed the reliability of the scan information. (auth)

7719 HEPATIC ARTERY TRAUMATIC ANEURYSM. Smith, W.; Ashare, A. B.; Saenger, E. L. (Univ. of Cincinnati). J. Nucl. Med.; 16: No. 11, 1027-1028(Nov 1975).

The diagnosis of intrahepatic aneurysm was suspected following radioisotope (/sup 99m/Tc-sulfur colloid and /sup 99m/Tc-albumin macroaggregates) scintigraphic studies. A patient developed abdominal pain following blunt abdominal trauma. The scintigrams of the liver revealed a large intrahepatic defect and separation between lung and liver. Angiogram revealed a large false aneurysm of the right hepatic artery. (auth)

7720 LIVER SCANNING AND THE INTRAHEPATIC GALLBLADDER: CASE REPORT. Schulz, R. C.; Shields, J. B.; Fletcher, J. W.; Donati, R. M. (St. Louis Veterans Administration Hospital). J. Nucl. Med.; 16: No. 11, 1029-1030(Nov 1975).

Hepatic focal defects identified with /sup 99m/Tc-sulfur colloid imaging procedures are nonspecific. This report describes a cause of an ectopic gallbladder localized by cholecystography and ^{131}I-rose bengal studies in a patient with cirrhosis and suspected intrahepatic neoplasm. (auth)

7721 PLAGUE AND THE GALLIUM SCAN: CASE REPORT. Stahly, T. L. Shoop, J. D. (Univ. of New Mexico, Albuquerque). J. Nucl. Med.; 16: No. 11, 1031-1032(Nov 1975).

Inflammation in the right axillary lymph nodes and the meninges was detected by ^{67}Ga-citrate scans in an 11-year-old boy with Yersinia pestis infection. This case provides another example of ^{67}Ga localizing to areas of infection, indicating potential utility in future cases of bubonic plague. (auth)

7722 RADIOASSAY OF CHROMIC PHOSPHATE ^{32}P SUSPENSION BY CHERENKOV COUNTING. Heitzman, M. W.; Ford, L. A. (Food and Drug Administration, Washington, DC). J. Assoc. Off. Anal. Chem.; 58: No. 5, 995-997(Sep 1975).

From 88th annual meeting of the AOAC; Washington, DC, USA (Oct 1974).

A simple and precise method is presented for the radioassay of chromic phosphate ^{32}P suspension by Cerenkov counting. An aliquot is weighed, dissolved, diluted, and then counted directly in a conventional liquid scintillation counter. The internal standard technique is used to provide color quench correction. This method is particularly useful for high specific activity samples. The standard deviation for the analysis of three aliquots, each determined in triplicate, was 1.9 percent. (auth)

7723 HIGH-SPEED SCINTILLATION AUTORADIOGRAPHY. Durie, B. G. M.; Salmon, S. E. (Univ. of Arizona, Tucson). Science; 190: No. 4219, 1093-1095(12 Dec 1975).

Impregnation of nuclear track emulsion with liquid scintillator and exposure at 85°C allows rapid autoradiographic labeling. With tritiated thymidine of high specific activity (40 to 60 curies per millimole), exposure time can be shortened to 20 to 60 minutes, allowing complete sample processing within 4 hours. In experiments requiring isotopes with low incorporation rates or low specific activity, exposure time can be shortened from months to several days. (auth)

MATERIALS

7724 (COO-3342-4) LOW TEMPERATURE AND NEUTRON PHYSICS STUDIES. Progress Report, September 1974–August 1975. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics). 19 Aug 1975. Contract E(11-1)-3342. 6p. Dep. NTIS $4.50.

Progress on and completion of various studies in solid state and neutron physics through use of neutron spectrometers is outlined. Topics discussed include: (a) characterization of the low temperature magnetization in the Cu(Fe) Kondo alloy, (b) study of the charge-density-wave phase transition in the superconductors $NbSe_2$ and $TaSe_2$, (c) neutron scattering by nuclearly polarized ^7Li, (d) extraneous scattering effects in the passage of polarized neutrons through high-field magnets, (e) preparation of neutron interferometer systems, and (f) revision of spectrometer facilities. (auth)

Ceramics and Cermets

Refer also to abstracts 7035, 7761, 7782, 7831, 7890, and 8708.

7725 (BNWL-SA-5513) HYDROLYSIS OF URANIUM CARBIDE FUEL BEADS. Bunnell, L. R.; Chikalla, T. D.; Woodley, R. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 18p. (CONF-751038-3). Dep. NTIS $4.50.

From American Ceramic Society; Seattle, Washington, USA (29 Oct 1975).

The rate of hydrolysis of bare and defected coated UC_2 fuel bead cores by water vapor was studied over a wide range of temperature and water vapor partial pressures (24–76 torr). Reaction products and nature of the reaction were studied by optical and scanning electron microscopy. The activation energy was determined to be 6.07 +- 0.70 kcal/mole. The major gaseous reaction products were identified as C_2H_6, CH_4, and H_2. (17 fig) (DLC)

7726 (CONF-751209-4) MAGNETOELASTIC INTERACTIONS IN UO_2. Faber, J. Jr.; Lander, G. H.; Cooper, B. R. (Argonne National Lab., Ill. (USA)). Dec 1975. Contract W-31-109-Eng-38. 9p. Dep. NTIS $4.50.

From 21st annual conference on magnetism and magnetic materials; Philadelphia, Pennsylvania, USA (9 Dec 1975).

Neutron diffraction measurements of the elastic magnetic scattering cross section from antiferromagnetic UO_2 show additional nuclear intensity below T/sub N/ equals 30.8°K. An examination was made of the possibility of analyzing the additional scattering in terms of homogeneous distortions, which involve shifts of the oxygen atoms from their fluorite lattice sites. The behavior arising from the presence of these homogeneous distortion modes formed the basis for Allen's theory of a cooperative Jahn–Teller effect in UO_2. However, an analysis in terms of these homogeneous distortions cannot explain the neutron data. But, by extending Allen's concepts to include inhomogeneous deformations, corresponding to a zone boundary q equals (pi/a) (1,0,0) phonon, excellent agreement is obtained between theory and experiment. The oxygen displacement is 0.014(1) A from the fluorite lattice positions and, in addition, the inhomogeneous deformation (T/sub 2g/(Q^1)–T/sub 1g/) does not require a reduction in the overall symmetry of the unit cell. The essential features of Allen's theory for UO_2 can still be maintained. (auth)

7727 (DOCKET-70925-1) URANIUM FUEL PLANT. Applicants Environmental Report. (Kerr-McGee Nuclear Corp., Oklahoma City, Okla. (USA)). May 1975. vp. Kerr-McGee Nuclear Corp., Oklahoma City, OK.

The Uranium Fuel Plant, located at the Cimarron Facility, was constructed in 1964 with operations commencing in 1965 in accordance with License No. SNM-928, Docket No. 70-925. The plant has been in continuous operation since the issuance of the initial license and currently possesses contracts extending through 1978, for the production of nuclear fuels. The Uranium Plant is operated in conjunction with the Plutonium Facility, each sharing common utilities and sanitary wastes disposal systems. The operation has had little or no detrimental ecological impact on the area. For the operation of the Uranium Fuel Fabrication Plant, initial equipment provided for the production of UO_2, UF_4, uranium metal and recovery of scrap materials. In 1968, the plant was expanded by increasing the UO_2 and pellet facilities by the installation of another complete production line for the production of fuel pellets. In 1969, fabrication facilities were added for the production of fuel elements. Equipment initially installed for the recovery of fully enriched scrap has not been used since the last work was done in 1970. Economically, the plant has benefited the Logan County area, with approximately 104 new jobs with an annual payroll of approximately $1.3 million. In addition, $142,000 is annually paid in taxes to state, local and federal governments, and local purchases amount to approximately $1.3 million. This was all in land that was previously used for pasture land, with a maximum value of approximately $37,000. Environmental effects of plant operation have been minimal. A monitoring and measurement program is maintained in order to ensure that the ecology of the immediate area is not affected by plant operations. (LK)

7728 (DP-MS-75-62) THERMAL CONDUCTIVITY OF $^{238}PuO_2$ POWDER, INTERMEDIATES, AND DENSE FUEL FORMS. Bickford, D. F.; Crain, B. Jr. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Oct 1975. Contract AT(07-2)-1. 31p. (CONF-751038-1). Dep. NTIS $5.00.

From American Ceramic Society; Seattle, Washington, USA (29 Oct 1975).

The thermal conductivities of porous $^{238}PuO_2$ powder (calcined oxalate), milled powder, and high density granules were calculated from direct measurements of steady-state temperature profiles resulting from self-heating. Thermal conductivities varied with density, temperature, and gas content of the pores. Errors caused by thermocouple heat conduction were less than 5 percent when the dimensions of the thermal conductivity cell and the thermocouple were properly selected. (auth)

7729 (DP-MS-75-67) HELIUM BUBBLES AT GRAIN BOUNDARIES OF HIGH-DENSITY $^{238}PuO_2$ SHARDS. McDonell, W. R.; Sheenan, J. E.; Sisson, R. D. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1975. Contract AT(07-2)-1. 23p. (CONF-751101-49). Dep. NTIS $4.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

Hydroxide- and oxalate-base $^{238}PuO_2$ shards that were sintered to high density at 1200 or 1600°C and then aged for 6 months or more exhibited grain-boundary gas bubbles due to agglomeration of alpha-decay helium when heated to 1200°C and above. Conditions for bubble formation depended markedly on shard microstructure; large-grained shards with few large residual sintering pores formed gas bubbles at lower temperatures than small-grained shards with many pores. This behavior was especially apparent in oxalate-base $^{238}PuO_2$, in which small-grained shards resisted bubble formation to above 1500°C; small-grained hydroxide-base shards with less internal porosity than oxalate-base shards formed bubbles at lower temperatures. Helium is apparently released from aged $^{238}PuO_2$ shards at high temperatures by bulk diffusion within grains to the grain boundaries, where bubbles are formed and interconnect into networks which permit helium escape. It is postulated that helium is released by grain boundary diffusion at temperatures below thresholds for grain boundary bubble formation. Small grain size and high residual porosity within grains inhibit the formation of the grain-boundary gas bubbles by reducing the concentration of helium gas at the grain boundaries. (10 fig) (auth)

7730 (KFK-2161) PREPARATION, STRUCTURE, AND PROPERTIES OF HAFNIUM COMPOUNDS IN THE SYSTEM Hf–C–N–O. Brundiers, G. D. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Aug 1975. 284p. (In German). Dep. NTIS (US Sales Only) $10.25.

Thesis. Submitted to Karlsruhe Univ. (F. R. Germany). Fakultaet fuer Maschinenbau.

Highly dense, homogenous and single-phase hafnium carbonitride samples (with low oxygen content) were prepared in the whole concentration range of the ternary cubic carbonitrides. Stoichiometric hafnium oxicarbides were also prepared within the range of solubility. The procedure involved the hot pressing of powders of HfC, HfN, Hf, Hf oxide and carbon at temperatures of 3000°C and pressures up to 550 kpf/cm² using a novel technique. Small single crystals of slightly substoichiometric HfN were also prepared. Densification of the powders was studied as a function of the nonmetal concentration. Carbonitrides with N/Hf ratio of 0.37 were prepared in a high temperature autoclave operating at medium pressures by the reaction of HfC with nitrogen. All the samples were characterized by density measurements, chemical, x-ray and metallographic analysis and in some cases with the aid of quantitative metallography and microprobe analysis. The phase studies were used to plot isothermal sections in the systems Hf–C–N and Hf–N–O and determine the existence range of the cubic δ-phase at 1500°C and 1 atm N_2 or Ar in the

system Hf–C–O. The properties investigated were lattice parameter, thermal expansion, microhardness, and electrical resistivity as function of the nonmetal content. The resistivity varies from 15 to 215 μmΩcm, the microhardness from 1200 to 2400 kp/mm², the thermal expansion coefficient from 4.9 to 7.7×10^{-6}/°K. The stoichiometric solid solution $HfC_{0.58}N_{0.42}$ has the highest hardness with low resistivity (42 μΩcm) and thermal expansion (7×10^{-6}/K). With the aid of the valence electron concentration (VEC) parameter, the properties can be correlated with the density of states of electrons at the Fermi level. In stoichiometric compounds extreme values of the properties are found at a VEC = 8.4 ± 0.1, at which the Fermi level is at a minimum of the density of states and high bonding energies are prevalent. In substoichiometric carbonitrides, the hardness maximum shifts with increasing vacancy concentration to lower values of the VEC. At the same time there is a decrease in the bond strength. This seems to indicate that the minimum in the density of states shifts to lower VEC values within the range 8–8.5 whilst broadening itself simultaneously. (auth)

7731 (KFK-2167) INVESTIGATIONS OF THE TERNARY URANIUM–ZIRCONIUM–OXYGEN SYSTEM. Politis, C. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Oct 1975. 57p. (In German). Dep. NTIS (US Sales Only) $ 5.50.

Boundaries of the phase fields in the U–Zr–O system were determined by means of specimens prepared under a powder metallurgical method at 1000, 1500, and 2000°C. It appears that the UO_2–Zr section corresponding to the contact in LWR's between fuel and cladding is not quasi-binary but that UO_2, α-Zr (O) and the (γ-U, β-Zr) solid solution occur as equilibrium phases at lower temperatures and $(U,Zr)O_2$ and melt, respectively, at elevated temperatures. UO_2, α-Zr (O) and 30 at.% oxygen are in equilibrium. The eutectic temperature in the α-Zr(O)-UO_2 quasi-binary system is 1800 ± 20°C, the distectic temperature at 2400 ± 30°C. Beginning of melting in the UO_2–ZrO_2–U–Zr subsystem of the U–Zr–O system was observed with an apparatus used for evaluation of the melting point. With the aid of high-temperature x-ray diffractometry, an improved Zr–O equilibrium diagram is proposed. In the course of LWR fuel pin meltdown, first liquid phases are already formed below 1500°C. (auth)

7732 (SAND-75-0130) BORON NITRIDE COMPOSITES BY CHEMICAL VAPOR DEPOSITION. Pierson, H. O. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1975. Contract AT (29-1)-789. 28p. Dep. NTIS $4.00.

Composites of boron nitride (BN) were made by the chemical vapor deposition of a BN matrix on a BN felt fiber substrate. Reactant gases were boron trifluoride and ammonia. The composites had a relatively high density (1.70 g/cm³), a crystallite size L/sub C/ equals 150 A, and an interlayer spacing d_{002} equals 3.35 A. Measurements of elastic modulus and thermal conductivity and expansion showed some anisotropy as a result of the preferred fiber orientation of the substrate. (7 tables, 5 fig) (auth)

7733 (UCID--16946) EQUATIONS OF STATE FOR THE CERAMICS BeO AND B_4C. Steinberg, D. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Nov 1975. Contract W-7405-Eng-48. 11p. Dep. NTIS $4.50.

Grueneisen equations of state with a simple constitutive model are described for the ceramics BeO and B_4C. (auth)

7734 INDUCED PHASE TRANSITIONS IN $TbPO_4$. Boehm, W. E. Karlsruhe, Ger.; Karlsruhe Univ. (1973). 36p. (In German). INIS.

Thesis.

The absorption spectrum of Tb^{3+} in $TbPO_4$ was investigated. From the slope of the spectral lines, the crystallographic and magnetic properties of $TbPO_4$ were found in relation to the temperature and an external magnetic field. At the temperature T_D= (3.3 ± 0.5) K, a crystallographic phase transition from a tetragonal to a lower symmetry occurs. This transition can be described by the cooperative Jahn-Teller effect theory. Furthermore, the subsequent antiferromagnetic order state below T_N = (2.15 ± 0.10) K was spectroscopically investigated: it was shown that $TbPO_4$ is an induced antiferromagnet. In addition, a few measurements of the magnetization and susceptibility on $TbPO_4$ which preceded the optical measurements could be understood from the interpretation of the spectra. (GE)

7735 INVESTIGATIONS INTO THE CRYSTAL STRUCTURE AND MAGNETIC STRUCTURE OF DISTORTED PEROVSKITES WITH NEUTRON DIFFRACTION. Jorns, E. Darmstadt, Ger.; Technische Univ. (1973). 133p. (In German). INIS.

Thesis.

The atomic parameters of the crystal structures of the compounds Sr_2NiTeO_6 and Sr_2NiWO_6 which crystallize in distorted perovskite type, were determined from neutron diffraction data. The magnetic structure of the Sr_2NiTeO_6 is explained at 4.2°K by an antiferromagnetic collinear model and that of the Sr_2NiWO_6 by an antiferromagnetic noncollinear model. Neel temperatures and magnetic moments are determined for these substances. The system $Sr_2(FeMo_xW_{1-x})O_6$ indicates two magnetic structures which exist next to each other in the phase region $0 < x < 0.3$: (1) an antiferromagnetic one as for the corner component Sr_2FeWO_6 and (2) a fine magnetic structure such as for Sr_2FeMoO_6. The ferromagnetic structure and the magnetic moment were determined for x = 0.3. (auth)

7736 EFFECT OF BURNUP ON RELEASE OF XENON FROM THORIA. Naik, M. C.; Paul, A. R.; Kaimal, K. N. G.; Karkhanavala, M. D. (Bhabha Atomic Research Center, Bombay). Radiat. Eff.; 25: No. 2, 73-77(1975).

Release behavior of fission ^{133}Xe from sintered ThO_2–1% $^{235}UO_2$ pellets and powders was studied as a function of burnup in the range of 2×10^{14} to 2×10^{15} fissions/cc by post-irradiation annealing at 1000°C. Below 2×10^{15} fissions/cc, the apparent diffusivity and initial burst, F′, is more or less dose independent. However, with increase of burnup beyond this level both D_b and F′ decrease sharply. The effect is more pronounced for the powder than for the pellets. The decrease in D_b and F′ with increasing dose was explained on the assumption that at higher dose irradiation, a part of gas atoms are immobilized at the radiation induced trapping centres. The fraction of trapping gas atoms and volume damaged per fission event were evaluated both for powders and pellets. The effect of irradiation dose on the kinetics of initial burst was worked out on the assumption that F′ is proportional to the fraction of free gas atoms near the surface constituting the burst. A relation between F′ and irradiation dose was derived. The values calculated from this expression agree well with the experimental values. (auth)

7737 EFFECT OF ION-BOMBARDMENT ON THE STRUCTURE OF Bi_2O_3, MoO_3, TeO_2, AND V_2O_5. Naguib, H. M. (McMaster Univ., Hamilton, Ont.); Kelly, R. Radiat. Eff.; 25: No. 2, 79-89(1975).

Bi_2O_3, MoO_3, TeO_2, and V_2O_5 have high ratio (crystallization temperature)/(melting temperature) values, as well as low ionicities, and are therefore expected to amorphize on ion impact. Such amorphization is shown to occur readily following the impact of 10 to 40-keV Kr ions: the gas-release spectra contained components having a dose dependence and temperature width suggestive of out-diffusion due to crystallization, and the amorphization was revealed by reflection electron diffraction at 60 or 80 kV. Doses for amorphization were lowest with TeO_2 and V_2O_5, and these, along with U_3O_8 and SiO_2, must be regarded as the substances most prone to bombardment-induced amorphization. Very high-dose bombardment of MoO_3 and V_2O_5 leads to preferential oxygen loss with resultant formation of MoO_2 and V_2O_3 as thin surface layers. Such oxygen loss does not occur with Bi_2O_3 and TeO_2. (DLC)

7738 DYNAMIC FRACTURE BEHAVIOR OF BORSIC–Al COMPOSITES. Hoover, W. R.; Allred, R. E. (Sandia Labs., Albuquerque, NM). pp 613-622 of Dynamic Crack Propagation. Sih, G. C. (ed.). Leiden; Noordhoff International Publishing (1973).

From international conference on dynamic crack propagation; Bethlehem, Pennsylvania, USA (9 Jul 1972). See CONF-720709-.

The impact behavior of unidirectional Borsic–Al composites has been studied using an instrumented Charpy system. In order to experimentally determine the most appropriate impact failure criterion for these composites, dynamic load-deflection traces were obtained under plane strain conditions. Specimens with crack length to width ratios (a/W) from 0.15 to 0.65 and crack root radii from 0.002 in. to 0.036 in. were utilized. Results indicated that the dynamic fracture toughness was independent of crack length over an a/W range of from about 0.20 to 0.50 while other fracture criteria such as the dynamic fracture stress, the strain to fracture and the energy absorbed per unit area of fracture surface varied continuously with crack length. Results also indicated that over the range of root radii studied, the dynamic fracture toughness was independent of crack acuity. Consequently, the dynamic fracture toughness appears to be an appropriate impact failure criterion for Borsic–Al composites and has been used to study the effects of the fiber-matrix bond strength and Borsic volume fraction. In addition, the dynamic behavior of these materials has been compared with their behavior during slow bend tests. (auth)

7739 EFFECT OF THE SHAPE OF THE DIAMOND GRIT ON THE WEAR RESISTANCE OF A GRINDING WHEEL IN THE GRINDING OF HARD ALLOYS. Zaitsev, A. G. Vestn. Mashinostr.; 2: 76-77(Feb 1975). (In Russian)

The grinding of WC–Co hard alloys with diamond wheels was studied from the point of view of optimizing the shape of the diamond grit. In choosing the optimum shape the over-all economy, namely, that of the grinding efficiency with respect to the alloy, and that of the life of the wheel itself, had to be taken into account. A table indicating the relative merits of different diamond grit shapes for a series of hard alloys is presented. (Metals Abstr.)

7740 EFFECT OF THE C → B TRANSITION ON THE CRACKING OF SINTERED EUROPIUM OXIDE PLATES. Ainscough, J. B.; Moore, D. A.; Osborn, S. C. (United Kingdom Atomic Energy Authority Reactor Group, Springfields). pp 13-20 of Proceedings of the Sixth Symposium on Special Ceramics. Popper, P. (ed.). Stoke-on-Trent, Eng.; British Ceramic Research Association (1975).

From 6th symposium on special ceramics; Stoke-on-Trent, England (9 Jul 1974).

Attempts to fabricate dense plates by cold sintering followed by sintering in CO_2 always led to cracking even though the same fabrication route had been operated successfully for 7-mm dia pellets. Experiments showed that cracking did not occur if the plates were pressed from the monoclinic (B) instead of the usual C-form of Eu_2O_3. This suggested that the C → B transformation, which occurs around 1075°C in Eu_2O_3, was taking place at different temperatures in different parts of the near-isothermal plates; therefore, the effect of atmosphere on the transformation temperature was investigated. The transformation temperature was about 75°C higher in hydrogen than in air. Analysis of the gases evolved from heated Eu_2O_3 powders gave results which suggested that the atmosphere in the interior of a plate is likely to be more reducing than at the surface and that, in consequence, tensile stresses will be set up at the surface of the plate. In practice it should be possible to eliminate cracking not only by starting with monoclinic Eu_2O_3 but also by sintering in reducing atmospheres and by heating rapidly to the sintering temperature. These alternatives are discussed. (auth)

7741 STRESSES DEVELOPED IN PYROLYTIC SILICON CARBIDE COATINGS DURING DEPOSITION AND COOLING. Airey, A. C.; Cartwright, P. J.; Popper, P. (British Ceramic Research Association, Stoke-on-Trent). pp 147-160 of Proceedings of the Sixth Symposium on Special Ceramics. Popper, P. (ed.). Stoke-on-Trent, Eng.; British Ceramic Research Association (1975).

From 6th symposium on special ceramics; Stoke-on-Trent, England (9 Jul 1974).

A method of estimating the stresses in a pyrolytic silicon carbide (PSC) coating during deposition and cooling is reported. The technique measures the change in the width of a slit cut along the length of a thin-walled graphite tube when the latter is coated, on the outside only, with PSC. Equations are derived which relate the observed slit movement to the stress which would be present in a similar PSC deposited on an uncut tube. Results show that stresses develop mainly during deposition and that the level of residual stress in the coating depends on the deposition conditions. PSC coatings deposited at 1300°C using a 6:1 H_2/methyltrichlorosilane (MTS) ratio had overall circumferential compressive stresses ~300 MN/m^2 while in those deposited at 1400°C using 4:1 H_2/MTS ratio the stresses were <55 MN/m^2. The overall stress was greatly influenced by a highly stressed layer of PSC formed during the first few minutes of deposition; formation of this layer could be prevented by adjusting the starting procedure. Only small additional stresses were developed on cooling. (auth)

7742 PROCEDURE FOR MANUFACTURING BAKED FINISHED PRODUCTS OF HAFNIUM CARBIDE. Spivak, I. I.; Andrievskii, R. A.; Klimenko, V. V. USSR Patent 417,245. 18 Jul 1974. Filed Date 9 Aug 1972. vp. (In Russian)

A procedure is proposed for manufacturing baked finished products of HfC, including hot compression of the powder. The procedure is distinguished by the fact that for the purpose of increasing the plasticity of the HfC powder and simplifying the technology of manufacturing the compact products, 3-25% VC is introduced into the powder before hot compression, after hot compression additional pressure treatment is performed, and then the VC is removed from the finished products by heat treatment at 2600-2800°. (Ref. Zh.)

7743 HIGH-PRESSURE-INDUCED PHASE TRANSITIONS IN BORON NITRIDE. Frantsevych, I. M.; Shlyankevych, O. M.; Kurdyumov, O. V. Visn. Akad. Nauk Ukr. RSR; No. 1, 8-18 (Jan 1975). (In Russian)

X-ray studies established the following peculiarities in the structure of shock-compression products of boron nitride: (a) The dense form of BN created as a result of the transition has a wurtzite-like structure; (b) the content of this phase depends on the synthesis conditions, but does not exceed 75-80 wt % (20-25% becomes graphite-like BN); (c) both the wurtzite-like and the residual graphite-like phases after the shock compression have a rather dispersed defect structure, the degree of defectiveness of the graphite-like BN growing with an increase in the percentage of yield, but the defectiveness of the wurtzite-like BN being practically independent of it. Dense diamond-like BN modifications are widely used for cutting and grinding tools. Well-known cutting tool materials include elbor-R and kubonite. A promising new superhard material is hexanite-R, developed in 1972 from a wurtzite-like modification of boron nitride. (43 references) (JPRS)

7744 THERMAL CYCLING BEHAVIOR OF PARTIALLY STABILIZED ZIRCONIA CERAMICS. Cooke, R. G. (Bath Univ., Eng.); Popper, P. pp 135-145 of Proceedings of the Sixth Symposium on Special Ceramics. Popper, P. (ed.). Stoke-on-Trent, Eng.; British Ceramic Research Association (1975).

From 6th symposium on special ceramics: Stoke-on-Trent, England (9 Jul 1974).

Results are presented for the performance of partially stabilized zirconia (PSZ) of ~65% monoclinic content and ~75% theoretical density under cyclic temperature variations, and a mechanism for the behavior of the material is suggested. It is considered that the phase transformation of the monoclinic phase results in the formation of small cracks between grains which may subsequently heal if the temperature is raised above the range in which the inversion occurs. The relative amounts of the damage and healing determine the final state and the form of damage which confers high thermal shock resistance on the material. Comparison with suggestions from other workers indicates that the proposed mechanism is likely to operate for low-density PSZ but that other effects are important in high-density zirconias. (auth)

7745 MECHANICAL PROPERTIES OF THE SYSTEM $PbO-B_2O_3-V_2O_5$ LOW MELTING GLASS DURING CRYSTALLIZATION BY HEAT-TREATMENT. Jung, C. J. Yo-up Hoeji; 11: No. 3, 85-92(1974). (In Korean)

Wettability of the system $PbO-B_2O_3-V_2O_5$ was excellent and appropriate for commercial sealing as a low melting solder glass. Crystals, during heat-treatment at 300°C of the system $PbO-B_2O_3-V_2O_5$, were β-$4PbO \cdot B_2O_3$, $5PbO \cdot 4B_2O_3$, and $Pb_2V_2O_7$ mainly. The percent of crystallinity was 82 ± 5%. Mechanical properties of the system $PbO-B_2O_3-V_2O_5$ were influenced not only by the differences of density and coefficient of thermal expansion and the stress induced from the difference in the density and coefficient of thermal expansion between glass phase and crystals but also crystallization conditions. (Korean Sci. Abstr.)

7746 STUDY OF NONSTOICHIOMETRIC RUTILE (TiO_2) AND NONSTOICHIOMETRIC RUTILE CONTAINING 1 TO 10 MOLE PERCENT COLUMBIA (Cb_2O_5). Dirstine, R. T. Cincinnati; Univ. of Cincinnati (1975). 158p. University Microfilms Order No. 75-22,391.

Thesis (Ph. D.).

The defect structure of nonstoichiometric rutile and rutile solid solutions prepared from TiO_2 and Nb_2O_5 was studied by weight measurements on samples reduced in carbon monoxide/carbon dioxide gas mixtures (P/sub O_2/ equals 10^{-12} to 10^{-18} atm) at 1000°C. The results indicate that the rutile solid solutions prepared from TiO_2 and Nb_2O_5 are either oxygen excess or metal deficit at 1 atm P/sub O_2/. The stoichiometry may be represented as MeO/sub Y/, where "Me" is the total cation composition and "Y" has values from 2 to 2.0291 for samples containing 0 to 3 mole percent Nb_2O_5. On reduction the stoichiometry for samples containing 1, 2, and 3 mole percent Nb_2O_5 is constant and equal to $MeO_{2.000}$ over the oxygen partial pressure range studied. For samples containing less than 1 mole percent Nb_2O_5, at the lower oxygen partial pressures the nonstoichiometry was found to be similar to the data for pure TiO/sub 2-X/. At 1000°C the weight change of TiO/sub 2-X/ was found to be proportional to P/sub O_2/sup -1/4.81/. A defect structure in terms of titanium interstitials is suggested. The solid electrolyte, $Th_{0.9}Y_{0.1}O_{1.95}$, was used in an electrochemical cell to measure the oxygen chemical potential in the specimens as a function of nonstoichiometry and temperature in the range 800 to 1200°C. The partial molar free energy of oxygen in solution in nonstoichiometric rutile was in excellent agreement to the results of previous investigators. The partial molar enthalpy of oxygen in solution in TiO/sub 2-X/, for 0.0 less than or equal to X less than or equal to 0.004 was -105.6(+-2.6) kcal/gm at. The partial molar free energy of oxygen in solution in rutile containing niobia (0 to 2 mole percent Nb_2O_5) was similar to that for pure nonstoichiometric rutile which had been reduced at a similar oxygen partial pressure. The partial molar enthalpy was approximately 10 kcal/gm at. more positive for samples containing niobia as compared with pure rutile. (Diss. Abstr. Int., B)

7747 LOW TEMPERATURE ELASTIC CONSTANTS OF (Ti/sub 1-x/V/sub x/)$_2$O$_3$. Bennett, J. G. Lafayette, IN; Purdue Univ. (1974). 97p. University Microfilms Order No. 75-17,158. Thesis (Ph. D.).

The transit times of 30 MHz longitudinal and shear ultrasonic waves in oriented, single-crystal samples of titanium sesquioxide with 0 percent, 0.1 percent, 4 percent, and 10 percent of the titanium replaced by vanadium were measured from 1.5 to 300^{0}K. The changes in length with temperature of single crystal samples along the c-direction and the a-direction were measured from 300 down to 80^{0}K and extrapolated from 80 to 1.5^{0}K. These measurements allowed all 6 adiabatic elastic constants to be determined from 1.5 to 300^{0}K for material with 0 percent, 2 percent, and 10 percent vanadium substitution. Values of c_{33} and c_{44} were obtained in this temperature range for 0.1 percent material; and values of c_{11}, c_{12}, c_{33}, c_{44}, and the absolute value of c_{14} were obtained for 4 percent material in this temperature range. From the values of the elastic constants of titanium sesquioxide at 1.5^{0}K an elastic Debye temperature of 715 +- 10^{0}K was deduced which is significantly larger than the calorimetric Debye temperature determined by Sjoestrand and Keesom. This discrepancy is discussed, but no definitive conclusion is drawn as to its origin. From measurements of the elastic constants at 1.5^{0}K of titanium sesquioxide with vanadium replacing some titanium, it is concluded that vanadium substitution produces changes in the elastic constants due to both lattice and electronic effects. Lattice effects are accounted for in terms of the dependence of lattice parameters on vanadium content using lattice parameter data of Loehman and Robinson. The electronic effects are accounted for by means of a deformation potential model using Van Zandt's density of electronic energy states. Results support Van Zandt's idea of the origin of the narrow band of vanadium states which overlie part of the titanium sesquioxide valence band. The effect of a magnetic field on the transit time of longitudinal ultrasonic waves traveling parallel to the field and the a-axis of a sample of titanium sesquioxide with 2 percent of the titanium replaced by vanadium was measured. The results imply that c_{11} increased almost linearly with magnetic induction reaching at 133 kG, a value 0.03 percent higher than the zero field value. This result is discussed, but no adequate explanation of it is given. (Diss. Abstr. Int., B)

7748 TiB_2 PARTICLES AS NUCLEANTS FOR ALUMINUM. Naess, S. E. (Central Inst. for Industrial Research, Oslo); Ronningen, J. A. Metallography; 8: No. 5, 391-400(Oct 1975).

Microhardness indentations have been used to locate clusters of TiB_2 particles in aluminum by transmission electron microscope studies. The irregularly shaped TiB_2 particles seen by optical microscopy are either rectangular or almost hexagonal in shape. An example of a TiB_2-matrix orientation relationship is shown. (auth)

7749 STRESS-INDUCED INTERACTION ENERGIES AND DETERMINATION OF THE ATOMIC STRUCTURE OF ORDERED BCC INTERSTITIAL SOLUTIONS, AND OF SUPERLATTICES IN TANTALUM. Khachaturyan, A. G.; Shatalov, G. A. (Inst. of Crystallography, Moscow). Acta Metall.; 23: No. 9, 1089-1102 (Sep 1975).

The method of static concentration waves and the theory of stress-induced interactions are used to predict the ordered arrangement of interstitials in bcc host lattice. The cases of impurity atoms occupying either octahedral or tetrahedral interstices are considered. The numerical parameters of the theory are the frequencies of the host lattice vibrations whose wave vectors are equal to the superlattice vectors of the reciprocal lattice, the elastice constants and the distortion tensor of the bcc lattice of the interstitial solution. The calculations allow, e.g., the determination of the atomic arrangement of the tantalum hydrides and suboxides and the atomic displacements in Ta_2H ordered phase, both being in a good agreement with the previous diffraction studies. (auth)

7750 PRESSURE DEPENDENCE OF T/sub c/ AND PHASE STABILITY FOR V_3Si. Shelton, R. N. (Univ. of California, San Diego, La Jolla); Smith, T. F. Mater. Res. Bull.; 10: No. 10, 1013-1016(Oct 1975).

Measurements of the superconducting transition temperature T/sub c/ for a transforming polycrystalline sample of V_3Si have been made as a function of hydrostatic pressure up to approximately 29 kbar. T/sub c/ increases over the entire pressure range with no evidence of the previously predicted maximum at approximately 24 kbar. A distinct break in the slope dT/sub c// dP does occur near 16 kbar which is coincident with the discontinuity in the pressure dependence of the lattice parameter reported by Blaugher et al. [Phys. Rev. Lett. 33: 292 (1974)]. (auth)

7751 CRYSTAL GROWTH AND STUDY OF THE STOICHIOMETRY OF NbO_2. Shin, S. H.; Halpern, T. H.; Raccah, P. M. (Yeshiva Univ., New York). Mater. Res. Bull.; 10: No. 10, 1061-1066(Oct 1975).

Large NbO_2 single crystals of controlled stoichiometry have been prepared by the Czochralski-Kyropoulos technique in a triarc furnace. A study of the stoichiometry shows that the compositional range of existence extends much further than was previously reported and that the conductivity depends on composition also in contrast with the earlier work. (auth)

7752 EFFECT OF PRESSURE ON THE SUPERCONDUCTING AND CRYSTALLOGRAPHIC TRANSITIONS OF La_3S_4, La_3Se_4, AND La_3Te_4. Shelton, R. N. (Univ. of California, San Diego, La Jolla); Moodenbaugh, A. R.; Dernier, P. D.; Matthias, B. T. Mater. Res. Bull.; 10: No. 10, 1111-1120(Oct 1975).

The superconducting transition temperatures (T/sub c/'s) for La_3S_4 and La_3Se_4 vary in a non-linear fashion under hydrostatic compression to 22 kbar. Both T/sub c/ and the crystallographic transformation temperature rise with pressure for La_3S_4 and show a maximum near 10 kbar for La_3Se_4. Non-transforming isostructural La_3Te_4 exhibits a linear pressure dependence of T/sub c/. However, the telluride undergoes a pressure induced phase transformation at approximately 70 kbar. In this case the sign of the pressure dependence is different from the sulfide and selenide. Variation of T/sub c/ with the crystallographic transformation temperature shows a new and unexpected behavior. (auth)

7753 PERCOLATION CONDUCTIVITY IN W--Al_2O_3 GRANULAR METAL FILMS. Abeles, B.; Pinch, H. L.; Gittlemen, J. I. (RCA Labs., Princeton, NJ). Phys. Rev. Lett.; 35: No. 4, 247-250(28 Jul 1975).

The growth of W grains in sputtered W-AL_2O_3 films as a consequence of annealing results in a narrowing of the transition region from metallic to nonmetallic conductivity. The conductivity, sigma, as a function of the volume fraction of the metal, x, exhibits a critical behavior given by sigma approximately (x-x/sub c/)/sup p/, where the critical volume fraction of the metal x/sub c/ equals 0.47 +- 0.05 and the critical exponent p equals 1.9 +- 0.2. For x less than 0.47 the temperature dependence of sigma has the form ln sigma approximately -1/root T which is characteristic of tunneling between isolated grains. (auth)

7754 PRODUCTION OF FILMS OF RARE-EARTH METAL OXIDES BY THE REACTION EVAPORATION METHOD. Samsonov, G. V.; Gil'man, I. Ya.; Andreeva, A. F. Poluch. Svoistva Tonkikh Plenok; No. 1, 74-78(1973). (In Russian).

The possibility was investigated of producing films of rare earth oxides by reaction evaporation in an oxygen environment at a pressure of 5×10^{-4} to 10^{-3} mm of mercury. Films with a thickness of 600 to 4000 Å were deposited on cold substrates and substrates heated up to 300°C, of pyroceramic and fuzed quartz. The condensates were annealed in air in the temperature range 100 to 600°C. Measurement of the thickness was made by the interference method, and the temperature coefficient ρ in an environment of purified argon. Films of the oxides of samarium, europium, gadolinium, terbium, thulium, ytterbium, and lutetium had an amorphous structure. Very weak and diffused Debye-Sherrer rings were observed on roentgenograms obtained from films of lanthanum oxide. Diffraction patterns from oxides of dysprosium, holmium, erbium, and neodymium were characterized by a comparatively large definition. With an increase of the partial pressure of oxygen, the films become more transparent. The optimum regime of deposition of films of rare earth oxides is oxygen pressure 5×10^{-4} mm of mercury, temperature of substrate heating 300°C, succeeding annealing of condensate at 600°C. (Ref. Zh.)

7755 SOME OPTICAL PROPERTIES IN YTTRIA STABILIZED ZIRCONIA. Aypar, A. (Univ. of Durham, Eng.). Tech. J. Ankara Nucl. Res. Cent.; 2: No. 2, 47-54(Jun 1975).

Optical properties (absorption, reflectivity, and refractive index) have been observed in 8 and 12 mole percent yttria-stabilized zirconia single crystals before and after blackening by dc current passage. Debye temperature derived from infrared lattice vibrational spectrum is also presented. (auth)

7756 EXPERIMENTAL EXPERIENCE CONCERNING THE HEAT-TREATMENT OF TUNGSTEN DIOXIDE. Sasvari, K. Acta Tech. Acad. Sci. Hung.; 78: No. 3/4, 283-286(1974).

It was shown that in a WO_2 pile heated to 900°C on a Pt or W sheet in Ar atmosphere, oxygen migrates from the hottest part (in contact with the metal holder) to the upper parts of the pile. After 5–10 min, the lowest layer will be found to consist of W metal powder with only a violet oxide layer of W_4O_{11} over it. In a further 5–10 min, $W_{20}O_{58}$ (blue oxide) appears on the upper part of the pile and starts to grow downwards. Finally colorless or gray WO_3 develops and thickens until the entire pile consists of only a W and a WO_3 layer. Such processes may play

a role in the reduction of tungsten oxides by H_2. (Hung. Tech. Abstr.)

7757 FREE ENERGIES OF FORMATION OF WC AND W_2C, AND THE THERMODYNAMIC PROPERTIES OF CARBON IN SOLID TUNGSTEN. Gupta, D. K. (Howmet Corp., Muskegan, MI); Seigle, L. L. Metall. Trans.; 6A: No. 10, 1939-1944(Oct 1975).

The activity of carbon in the two-phase regions W + WC and W + W_2C has been obtained from the carbon content of iron rods equilibrated with mixtures of metal plus carbide powders. From this activity data the standard free energies of formation of WC and W_2C have been calculated to be DELTA G^0/sub f/(WC) equals – 10,100 + 1.19T +– 100 cal/mode (–42,300 + 4.98T +– 400 J/mole) (1150 to 1575°K), DELTA G^0/sub f/(W_2C) equals –7300 – 0.56T +– 100 cal/mole (–30,500 – 2.34T +– 400 J/mole) (1575 to 1660°K). The temperature of the eutectoid reaction W_2C equals W + WC was fixed at 1575 +– 5°K. Using available data for the solubility of C in solid W, the relative partial molar free energy of C in the dilute solid solution was calculated to be DELTA anti G/sub C//sup alpha/ equals 23,000 – [0.68 – R ln X/sub C//sup alpha/]T +– 3000 cal/mole (96,200 – [2.85 – R ln X/sub C//sup alpha/]T +– 12,600 J/mole). The heat solution of C in W obtained was DELTA anti H/sub C//sup alpha/ equals 23,000 +– 5000 cal/mole (96,200 +– 20,000 J/mole) and the excess entropy for the interstitial solid solution, assuming that the carbon atoms are in the octahedral sites, DELTA anti S/sub C//sup alpha/(xs,i) equals –1.5 +– 2 cal/deg-mole (–6.3 +– 8 J/deg-mole). (auth)

7758 INTERACTION OF STABILIZED ZrO_2 WITH SILICA. Strakhov, V. I.; Zhukovskaya, A. E.; Sergeev, G. G.; Shmitt-Fogelevich, S. P. (Lensovet Technological Inst., Leningrad). Refractories (USSR) (Engl. Transl.); 15: No. 11-12, 701-704 (1974).

Translated from Ogneupory; 15: No. 11, 41-44(Nov 1974).

Processes used to produce refractories based on cubic solid solutions of ZrO_2–Nd_2O_3 were investigated. Chemical phase analysis and radiography were used to determine the sequence and rate of the solid-phase reactions developing in mixtures of $Nd_2Zr_2O_7$ with SiO_2 at 1200 to 1600°C. It was established that the cubic solid solution in fine-ground mixtures of SiO_2 with ZrO_2 stabilized with 12 mole % Nd_2O_3 is decomposed rapidly at 1750°C and forms tetragonal ZrO_2 which on cooling is converted to monoclinic ZrO_2. An investigation of the influence of the added SiO_2 on the properties of zirconia refractories showed that with 20% of the neodymium stabilizer combined with the silica the thermal-shock resistance and strength of the refractory increase appreciably. Data was obtained relating to the nature and degree of the interaction of a melt of quartz glass with ZrO_2 stabilized with Nd_2O_3. The rate of wear of this type of zirconia refractory depends mainly on the rate of the reaction of the SiO_2 with the Nd_2O_3 stabilizer. The process does not result in the contamination of the molten glass. (auth)

Metals and Alloys

7759 (AED-CONF-75-281-002) PROBLEMS OF THE SUPPLY OF RAW MATERIALS FOR STEEL ALLOYS. Haferkamp, H. 1975. 39p. (In German). INIS.

From Dechema annual meeting; Frankfurt, F. R. Germany (26 Jun 1975).

7 figs.

A survey is given on the supply of raw metals, of the alloy elements Mn, Cr, Ni, Mo, W, Co, V, which play an important part as "steel-refining elements" in the steel-producing industry, and of the special metals Nb and Te. This information is followed by a comparison of the supply situation for crude oil and for the basic material iron ore, an assessment on the future development of demand and production with an assumed shortage of raw materials, the solutions to the supply problems of the steel industry, and the national raw materials policy. (GE)

7760 INTERFACIAL PHENOMENA IN METALS AND ALLOYS. Murr, L. E. Reading, MA; Addison-Wesley Publishing Company (1975). 387p. $24.50.

Data and information are presented on the thermodynamic properties, structures, and characteristics of interfaces which control the bulk and surface behavior of materials. Chapters are included on thermodynamics of solid interfaces, interfacial equilibria, interfacial free energy, structure of interfaces, and properties of interfaces. (JRD)

7761 MECHANICAL PROPERTIES. Volume 1. Woehlbier, F. H. (ed.). Materials Reference Series II. Bay Village, OH; Trans Tech Publications (1975). vp.

A compilation of information on the mechanical properties of inorganic materials is presented. The compilation is one of a series issued in two volumes per year. Information and data are included on ferrous metals and alloys, nonferrous metals and alloys, ionic materials, semiconducting materials, ceramic materials, and composite materials. (JRD)

7762 COMBUSTION MODELING: URBAN AND WILDLAND FIRES. 1974 Fall Meeting of the Western States Section/The Combustion Institute, Northridge, California, October 21–22, 1974. Northridge, CA; Western States Section/The Combustion Institute (1974). vp. (CONF-741049-). $25.00.

Nineteen of the papers presented at the conference are compiled. Separate abstracts were prepared for two papers, and ten papers were processed for inclusion in ERDA's energy data bases. (JSR)

For abstracts of individual papers see: 7775 and 7776.

Corrosion and Erosion

Refer also to abstract 8719.

7763 (AECL-5019) CORRELATION OF MICROSTRUCTURE AND CORROSION PERFORMANCE OF Zr–1.15 WT % Cr–0.1 WT % Fe IN WATER AND STEAM. Northwood, D. O.; Bahen, L. E. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1975. 33p. Dep. NTIS (US Sales Only) $ 5.00. AECL $1.00.

The corrosion performance in 573°K pressurized water and 773°K steam of an alloy of nominal composition Zr–1.15 wt % Cr–0.1 wt % Fe is correlated with metallurgical structure, particularly the volume fraction of the $ZrCr_2$ intermetallic phase. In 573°K pressurized water, the best corrosion resistance is shown by a material containing a very small amount (≈ 1 vol %) of small (< 30 nm) $ZrCr_2$ particles, whereas the best material in 773°K steam contains a larger amount (≈ 4 vol %) of $ZrCr_2$ particles with a mean size of about 170 nm. The size of the precipitates also affects the morphology of the oxide formed during corrosion in 573°K water, large precipitates leading to a localized pustule-like oxide. Materials which have not recrystallized show preferential hydride precipitation at the prior β-grain boundaries during corrosion in 773°K steam. A material having a recrystallized α-structure, and an even distribution of fine (< 0.15 μm) $ZrCr_2$ particles is suggested as a compromise for service in water and steam at 573-773°K. (14 fig., 7 tables) (auth)

7764 (AECL-5112) HYDRIDING OF Zr_3Al-BASED ALLOYS IN AN ORGANIC REACTOR COOLANT. Cameron, D. J.; Unger, A. E. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jul 1975. 23p. Dep. NTIS (US Sales Only) $4.50. AECL $1.00.

Specimens with compositions between 8.3 and 9.6 wt %Al were exposed to coolant in the out-reactor portion of A-circuit of WR-1 for periods up to 340 days at a temperature of ~ 673°K. Rates of hydrogen uptake from the coolant are comparable with those in Zircaloy-2, Zircaloy-4, and Zr–2.5% Nb hydrided under similar conditions. No visible effects of hydriding were observed, except in samples of Zr–8.3% Al alloys when they contained more than 800 μg/g of hydrogen. In these specimens, Zr_2Al formed by the decomposition of Zr_3Al was found at the Zr_3Al grain boundaries. The location of the α–Zr, the other product of the decomposition, was not conclusively established. A layer of amorphous type material was commonly found between the grain boundary decomposition product and the unaltered Zr_3Al. The physical significance of this layer is not understood. Higher temperature annealing experiments on the hydrided samples of Zr–8.3%Al alloy indicate that 800 μg/g hydrogen does not represent the thermodynamic limit of hydrogen solubility without decomposition, but that the real limit is considerably less than this value, and samples containing less than 800 μg/g hydrogen are maintained in a meta-stable condition at 673°K by difficulties in nucleating the decomposition reaction. (auth)

7765 (GEAP-14029-4) STEAM GENERATOR MATERIALS ENGINEERING. Progress Report, April--June 1975. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Jul 1975. Contract AT(04-3)-893. 33p. AT.

The primary objective of the work reported is to characterize materials, mainly 2¼Cr–1Mo and stainless steels, to assure that satisfactory materials compatibility is achieved with expected LMFBR steam generator environments. Major accomplishments for this quarter were as follows: Decarburization exposure in sodium achieved 10,000 hours; anodic polarization curves were completed on 2¼Cr–1Mo and Incoloy 800; creep-fatigue tests of Type-316 stainless steel in high carbon sodium are in progress (initial creep data were obtained); and the Intermediate System Mockup Loop was completed and sodium was pumped through the loop for five hours. (DLC)

7766 (KAPL-P-4042) CONSEQUENCES OF IMPROPER EVALUATION OF CORROSION RELATED FAILURES: CASE HISTORIES REVIEWED. Suss, H. (Knolls Atomic Power Lab., Schenectady, N. Y. (USA)). 1975. 21p. (CONF-751123-1). Dep. NTIS $4.50.

From ASM-TMS/AIME materials science symposium; Cincinatti, Ohio, USA(13 Nov 1975).

Three case histories are reviewed in which the initial evaluation was wrong but was revised; the potential problems that could have developed had not the initial evaluation been modified are described. The case histories are: AISI 440C (R/sub c/ 50–55) for bearing application in which a "stress-corrosion" crack was found to be a mechanical one caused by overload; perforations in brass tubes of heat exchanger which were found to be caused by vibrations and not by attack by acid cleaning solution; and cracking of a type 304 stainless steel bellows which was eventually determined to be due to caustic stress corrosion and not to chloride stress corrosion. (DLC)

7767 (ORNL-5080) TWIN BOUNDARY CAVITATION IN AGED TYPE 304 STAINLESS STEEL. Sikka, V. K.; Swindeman, R. W.; Brinkman, C. R. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 40p. Dep. NTIS $4.00.

A transition from grain to twin boundary cavitation was observed in aged-and-creep-tested type 304 stainless steel. Evidence of twin boundary cavitation has also been observed for unaged material under certain test conditions. This same behavior was also found in aged type 316 stainless steel. Several possible reasons have been suggested for the absence of frequently observed grain boundary cavitation. (auth)

7768 HYDROGEN EMBRITTLEMENT TESTING. Seventy-fifth Annual Meeting of the American Society for Testing and Materials, Los Angeles, CA, June 25–30, 1972. Philadelphia; American Society for Testing and Materials (1974). 280p. (ASTM-STP-543; CONF-720672–). $29.75.

Sixteen papers were presented at the symposium. A separate abstract was prepared for each of seven papers selected for inclusion in Nuclear Science Abstracts. Papers for which no abstracts were prepared are concerned with mechanical testing methods and notch tests. (JRD)

For abstracts of individual papers see: 7769–7774, and 7877.

7769 ELECTROCHEMICAL TECHNIQUES. Dull, D. L.; Raymond, L. (Aerospace Corp., El Segundo, CA). Am. Soc. Test. Mater., Spec. Tech. Publ.; No. 543, 20-33(1974).

From 75th annual meeting and exposition of the American Society for Testing and Materials; Los Angeles, California, USA (25 Jun 1972). See ASTM-STP-543; CONF-720672-.

An electrochemical test method is proposed for determination of the susceptibility of materials to internal hydrogen embrittlement (IHE). The method is based on the assumption that the relative susceptibility of a material depends both on the specific aqueous environment to which the material is exposed and to the dissimilar materials to which it is coupled. Potentiostatic techniques are employed to impress potential on sustained loaded notched round-bar specimens. The result is a plot of impressed potential versus time to failure; superpositioning of the resultant curves provides a basis for rating the relative susceptibility of various materials to IHE. (auth)

7770 NOTCHED C-RING TEST. Jankowsky, E. J. (Naval Air Development Center, Warminster, PA). Am. Soc. Test. Mater., Spec. Tech. Publ.; No. 543, 51-57(1974).

From 75th annual meeting and exposition of the American Society for Testing and Materials; Los Angeles, California, USA (25 Jun 1972). See ASTM-STP-543; CONF-720672-.

High-strength steel notched C-rings have proven to be useful specimens for studying the effects of hydrogen embrittlement, as well as screening plating processes, cleaning, and paint removal materials for use on naval aircraft parts. The specimen and some of its uses are described. (auth)

7771 TESTING FOR HYDROGEN ENVIRONMENT EMBRITTLEMENT: EXPERIMENTAL VARIABLES. Gray, H. R. (Lewis Research Center, Cleveland). Am. Soc. Test. Mater., Spec. Tech. Publ.; No. 543, 133-151(1974).

From 75th annual meeting and exposition of the American Society for Testing and Materials; Los Angeles, California, USA (25 Jun 1972). See ASTM-STP-543; CONF-720672-.

Hydrogen embrittlement is classified into three types: internal reversible hydrogen embrittlement, hydrogen reaction embrittlement, and hydrogen environment embrittlement. Characteristics of and materials embrittled by these types of hydrogen embrittlement are discussed. Hydrogen environment embrittlement is reviewed in detail. Factors involved in standardizing test methods for detecting the occurrence of and evaluating the severity of hydrogen environment embrittlement are considered. The effects of test technique, hydrogen pressure, gas purity, strain rate, stress concentration factor, and test temperature are discussed. Additional research is required to determine whether hydrogen environment embrittlement and internal reversible hydrogen embrittlement are similar or distinct types of embrittlement. (auth)

7772 TESTING TO DETERMINE THE EFFECT OF HIGH-PRESSURE HYDROGEN ENVIRONMENTS ON THE MECHANICAL PROPERTIES OF METALS. Chandler, W. T.; Walter, R. J. (Rockwell International, Canoga Park, CA). Am. Soc. Test. Mater., Spec. Tech. Publ.; No. 543, 170-197(1974).

From 75th annual meeting and exposition of the American Society for Testing and Materials; Los Angeles, California, USA (25 Jun 1972). See ASTM-STP-543; CONF-720672-.

Equipment and procedures used in performing tension, fracture mechanics, fatigue, and creep tests on metal specimens in high-pressure hydrogen are described. Important test parameters, in particular, hydrogen purity and methods of achieving high purity are considered. The interpretation and use of data obtained from the various tests in high-pressure hydrogen are discussed. (auth)

7773 VARIOUS MECHANICAL TESTS USED TO DETERMINE THE SUSCEPTIBILITY OF METALS TO HIGH-PRESSURE HYDROGEN. Harris, J. A. Jr.; VanWanderham, M. C. (Pratt and Whitney Aircraft, West Palm Beach, FL). Am. Soc. Test. Mater., Spec. Tech. Publ.; No. 543, 198-220(1974).

From 75th annual meeting and exposition of the American Society for Testing and Materials; Los Angeles, California, USA (25 Jun 1972). See ASTM-STP-543; CONF-720672-.

The use of hydrogen as a rocket fuel has been successfully established; however, it has also been established that many metals are degraded in one or more of their properties by environmental gaseous hydrogen. The degree of degradation may range from slight to extreme, depending on the metal being analyzed and the type of test or tests used. Many important variables, such as environment, stress, temperature, and time must be considered in selecting the test to be used to determine the susceptibility to gaseous hydrogen. Types of tests are discussed such as: (1) tensile (smooth and notched), (2) strain-controlled, low-cycle fatigue, (3) high-cycle fatigue, (4) creep-rupture, and (5) fracture toughness, used to determine degradation of specific material properties and enable general observations in regard to the susceptibility of various materials to hydrogen degradation. (auth)

7774 DISK PRESSURE TESTING OF HYDROGEN ENVIRONMENT EMBRITTLEMENT. Fidelle, J. P.; Bernardi, R.; Broudeur, R.; Roux, C.; Rapin, M. (Centre d'Etudes de Bruyeres-le-Chatel, France). Am. Soc. Test. Mater., Spec. Tech. Publ.; No. 543, 221-253(1974).

From 75th annual meeting and exposition of the American Society for Testing and Materials; Los Angeles, California, USA (25 Jun 1972). See ASTM-STP-543; CONF-720672-.

The rupture appearances and pressures are compared for clamped disks, biaxially stressed to rupture under upward increasing pressures of helium or of an embrittling fluid such as gaseous hydrogen isotopes. Usually the downward surface is available for observation during the test in progress, but it can be exposed to a second embrittling medium. Factors studied include: (a) for the materials; chemistry (aluminum, cobalt, chromium, copper, iron, nickel, platinum, titanium, uranium, and zirconium, base), surface conditions, thermomechanical processing, and welding, (b) for the testing conditions (-196 to -450^{0}C), H_2 pressure, purity, and pressure increase rate. Low-cycle fatigue and delayed failure tests can also be conducted and discontinuous cracking monitored by various techniques, especially permeation. The disk pressure test (DPT) can be used for selection and quality control of bulk materials, protective coatings against hydrogen environment embrittlement (HEE), and their processing. Materials selection is made according to screening tests of increasing severity. The DPT shows evidence of other causes of embrittlement and their synergistic effects with HEE, which is quite important. Other advantages of DPT, such as sensitivity, versatility, rapidity, simplicity of operation and maintenance, safety, low cost of specimens, and equipment, are outlined and compared with other methods. (auth)

7775 ZIRCONIUM–OXYGEN PHOTOFLASH REACTION AT OXYGEN PRESSURES FROM 1 TO 124 ATMOSPHERES. Nelson, L. S. (Sandia Labs., Albuquerque, NM); Northrup, C. M. M. Jr.; Wemple, R. P.; Richardson, N. L.; Fastle, D. J.; Planner, H. N.; Keil, K. pp Paper No. 74-34 of Combustion Modeling: Urban and Wildland Fires. Northridge, CA; Western States Section/The Combustion Inst. (1974).

From meeting of the Western States Section/The Combustible Institute; Northridge, California, USA (21 Oct 1974). See CONF-741049-.

The zirconium wool–oxygen photoflash reaction has been studied in oxygen at pressures from 1 to 125 atmospheres. The luminous emission was studied with photomultiplier and calibrated photographic spectroscopic techniques; also, the reactions were photographed with a high speed camera. The wool combustion is a highly chaotic process occurring as a summation at any given instant of individual droplets with varying diameters having reacted to different degrees. Vapor phase-related phenomena (explosions, halos, and smoke deposition) are suppressed or reduced at higher oxygen pressures, probably due to the increased hydrostatic forces. The light emitted increases in peak intensity (2-fold in the red to 4.5-fold in the blue), and decreases in pulse width and pulse asymmetry as the oxygen pressure is increased from 1 to 125 atmospheres. At the same time, the average peak radiance temperature increases from about 3600 K to 4400 K. The emission approximates a blackbody to within +–3 percent even at the highest pressures, but the temperature falls considerably below that expected from published vapor pressure/temperature relationships for the zirconium–oxygen system. (auth)

7776 CORRELATION BETWEEN EXPLOSION TIMES AND INITIAL MOLAR CONTENT FOR METAL DROPLETS BURNING IN AIR. Nelson, L. S. (Sandia Labs., Albuquerque, NM); Freese, J. M.; Richardson, N. L.; Planner, H. N.; Keil, K. pp Paper No. 74-35 of Combustion Modeling: Urban and Wildland Fires. Northridge, CA; Western States Section/The Combustion Inst. (1974).

From meeting of the Western States Section/The Combustion Institute; Northridge, California, USA (21 Oct 1974). See CONF-741049-.

The free-fall combustion of submillimeter-diameter droplets of eleven transition and rare earth metals in dry air has been studied by a laser ignition technique. Each metal burned in a similar, coherent manner and exploded after a reproducible combustion time. For a given droplet diameter, a linear correlation between the time to explode and the number of moles of metal present in the droplet upon ignition was discovered. If the analogy may be drawn with earlier work on zirconium droplet combustion, the apparent oxygen transfer rate is constant from metal to metal. Since it is unlikely that all eleven metals have identical intrinsic oxygen uptake rates, the oxygen supply must be limited by diffusion through the boundary layer which surrounds the droplets for the combustion conditions studied here. These experiments place a lower limit on the intrinsic oxygen uptake rates of the eleven molten metals during high temperature oxidation. (auth)

7777 REVIEW OF CORROSION PHENOMENA ON ZIRCONIUM ALLOYS, NIOBIUM, TITANIUM, INCONEL, STAINLESS STEEL, AND NICKEL PLATE UNDER IRRADIATION. Johnson, A. B. Jr. (Battelle Memorial Inst., Richland, WA). Rev. Coatings Corros.; 1: No. 4, 299–365(1975).

The role of nuclear fluxes in corrosion processes was investigated in ATR, ETR, PRTR, and in Hanford production reactors. Major effort was directed to zirconium alloy corrosion parameter studies. Corrosion and hydriding results are reported as a function of oxygen concentration in the coolant, flux level, alloy composition, surface pretreatment, and metallurgical condition. Localized corrosion and hydriding at sites of bonding to dissimilar metals are described. Corrosion behavior on specimens transferred from oxygenated to low-oxygen coolants in ETR and ATR experiments is compared. Mechanism studies suggest that a depression in the corrosion of the Zr–2.5Nb alloy under irradiation is due to radiation-induced aging. The radiation-induced onset of transition on several alloys is in general a gradual process which nucleates locally, causing areas of oxide prosity which eventually encompass the surface. Examination of Zry-2 process tubes reveals that accelerated corrosion has occurred in low-oxygen coolants. Hydrogen contents are relatively low, but show some localized profiles. Gross hydriding has occurred on process tubes containing aluminum spacers, apparently by a galvanic charging mechanism. Titanium paralleled Zry-2 in corrosion behavior under irradiation. Niobium corrosion was variable, but did not appear to be strongly influenced by radiation. Corrosion rates on Inconel and stainless steel were only slightly higher in-flux than out-of-reactor. Corrosion rates on nickel-plated aluminum appeared to vary substantially with preexposure treatments, but the rates generally were accelerated compared to rates on unirradiated coupons. (59 references, 11 tables, 12 figs.) (auth)

7778 ENVIRONMENTALLY INDUCED CRACKING OF ZIRCONIUM ALLOYS. Cox, B. (Chalk River Nuclear Lab., Ont.). Rev. Coatings Corros.; 1: No. 4, 367–422(1975).]

Although a relatively much smaller amount of work was reported on the SCC and LME of zirconium alloys than on titanium alloys, it is evident that both alloy systems are susceptible to cracking in similar environments. Mechanistic studies on cracking of zirconium alloys have been few, and show some significant differences from similar studies on titanium alloys. Thus, it is not possible to find any convincing evidence for hydrogen participating in the transgranular SCC processes in zirconium alloys and electrochemistry seems to be unimportant in many environments (e.g., I_2 vapor). Since, for LME, the reduction in bond strength resulting from adsorption of the liquid metal atoms at the crack tip appears to be an acceptable mechanism, it is concluded that a similar absorption of halogen atoms in a suitable chemical form is the most probable explanation for transgranular cracking processes. Intergranular cracking appears to be readily explicable on the basis of preferential chemical or electrochemical attack at grain boundaries. (65 references, 25 fig) (auth)

7779 EFFECT OF SEA WATER SALTS IN A GAS FLOW OF VARYING PARAMETERS ON THE REDUCTION IN MECHANICAL PROPERTIES OF MATERIALS. Tret'yachenko, G. N.; Kravchuk, L. V.; Konev, V. A.; Rudenko, V. N. (Inst. of Strength Problems, Kiev). Strength Mater. (USSR) (Engl. Transl.); 6: No. 11, 1344–1347(Nov 1974).

Translated from Probl. Prochnosti; 6: No. 11, 49–52(Nov 1974).

Part of the samples of EHI826, EHI868, and EHI437BVD were held in an electric furnace, part were thermally cycled 740–910°C, and the rest were tested under a gas flow with seawater salts. Changes in the tensile and yield strengths were measured. Results show that the strength decreases under both static and dynamic conditions, and that seawater salt (1 mg/m^3 air) increases this loss. (DLC)

7780 CHANGES IN THE MECHANICAL PROPERTIES OF STEEL 1Kh16N15M3B IN THE SODIUM–NITROGEN SYSTEM AT 500 TO 800°. Starkov, O. V.; Kononov, E. S. Prot. Met. (USSR) (Engl. Transl.); 11: No. 1, 59–61(1975).

Translated from Zashch. Metal.; 11: No. 1, 63–66(1975).

An investigation was made of the transfer of N_2 through liquid Na and its effect on the ultimate strength and elongation of this steel. An equation was derived for the variation in the elongation: $\Delta\delta/\delta_i = 123 \exp(-18{,}000/RT)\, P^{0.5}\, \tau^{0.5}$, where P and τ are the nitriding pressure (kg/cm^2) and time (h). (DLC)

7781 CORROSION OF MOLYBDENUM IN MOLTEN SODIUM CHLORIDE IN THE PRESENCE OF CARBON. Ozeryanaya, I. N.; Zalazinskii, G. G.; Smirov, M. V.; Finkel'shtein, S. D.; Shamanova, N. D. (Urals Scientific Center, Sverdlousk, USSR). Prot. Met. (USSR) (Engl. Transl.); 11: No. 1, 62–64(1975).

Translated from Zashch. Metal.; 11: No. 1, 66–68(1975).

The corrosion was studied at 850 to 1000°C in pure NaCl and in NaCl in contact with pyrographite or glass-carbon about 10 mm away from the Mo. Results show that the C is tranported chiefly in the form of small elementary particles. Experiments using C as CO + CO_2 or carbonate anions were also conducted. (DLC)

7782 STRUCTURE AND PHASE COMPOSITION OF ANODIC FILMS ON BERYLLIUM. Al'tovskii, R. M.; Gornyi, D. S.; Momin, E. Yu.; Urazbaev, M. I. Prot. Met. (USSR) (Engl. Transl.); 11: No. 1, 87–89(1975).

Translated from Zashch. Metal.; 11: No. 1, 89–91(1975).

Pure (99%) Be cylinders were anodized at various voltages. The films were studied using replica electron microscopy and diffraction. Effects of annealing were studied. Results suggest that films produced at voltages over 60 V consist of crystalline BeO and are similar (pores, cells) to Keller's model of anodic films on Al, and that films formed at low voltages (5–15 V) are amorphous, do not have cells, and are pierced by pores in the normal and tangential directions. (DLC)

7783 PREPARATION OF A NIOBIUM SURFACE UNDER A NICKEL–PHOSPHORUS COATING. Zuikova, V. S.; Maslennikov, A. F.; Kvokova, I. M. (Moscow Inst. of Steel and Alloys). Prot. Met. (USSR) (Engl. Transl.); 11: No. 1, 119–121(1975).

Translated from Zashch. Metal.; 11: No. 1, 118–121(1975).

A potentiostatic and potential drop study was made of the condition of the Nb surface with cathodic treatment in alkaline solutions with and without NaCl and its effect on the adhesion of chemical Ni coatings. Kinetics of H evolution on the Nb were also studied. It was found that cathodic treatment of Nb in 5M KOH + 1M NaCl provides strongly adhesive plated Ni coatings up to 30–40μ thick (plating rate = 3μ/h in combination with an increased surface catalytic activity. For improved adhesion, baking at 200° in air for 2 h is recommended. (DLC)

7784 KINETICS OF GALVANODIFFUSIVE CALORIZING OF MOLYBDENUM FROM A CHLORIDE SALT MELT. Andreev, Yu. A.; Fokin, M. N.; Batenina, O. I.; Ryabikov, N. A. Prot. Met. (USSR) (Engl. Transl.); 11: No. 1, 122–124(1975).

Translated from Zashch. Metal.; 11: No. 1, 121–124(1975).

The process of galvanodiffusive calorization (coating with Al to protect against temperatures of 1800°F) was investigated for Mo, using a NaCl–KCl melt with small additions of $AlCl_3$. Effects of cathodic current density and electrolysis time were studied. Optimum $AlCl_3$ content was determined to be 1 to 2.5 mole %

$AlCl_3$, resulting in low volatility losses. The deposited phases were found to be mainly $MoAl_{12}$, Mo_3Al_8, and $MoAl_5$. (DLC)

7785 INVESTIGATION OF THE SURFACE LAYER STRUCTURE AND CHEMICAL INHOMOGENEITY OF NOZZLE VANES TESTED UNDER CONDITIONS OF THERMAL CYCLING OF A GAS FLOW WITH SEA WATER SALT. Tret'yachenko, G. N.; Konev, V. A.; Chuprina, V. G.; Marushi, O. I. (Inst. of Strength Problems, Kiev). Strength Mater. (USSR) (Engl. Transl.); 6: No. 11, 1300-1302(Nov 1974).

Translated from Probl. Prochnosti; 6: No. 11, 8-10(Nov 1974).

Results are given of an investigation of the change in alloy conditions for the leading edges of marine gas turbine vanes tested in thermal cycling (700-1050°C) with added seawater salts. The alloy was EHI868. Chemical composition (Cr, Al, Ti, W) of the surface layer was determined by x-ray microanalysis. Results show that seawater salts catalyze the chemical reactions, and the alloy loses strength. (DLC)

7786 APPLICATION OF THE NGR METHOD FOR INVESTIGATING THE REDISTRIBUTION OF IRON ATOMS IN ZIRCONIUM ALLOYS DURING CORROSION. Babikova, Yu. F.; Gruzin, P. L.; Ivanov, A. V.; Filippov, V. P. At. Energ. (USSR); 38: No. 3, 138-142(Mar 1975). (In Russian).

The NGR method is used to investigate the redistribution of iron atoms in zirconium alloys during corrosion under conditions of low air pressure ($p = 10^{-2}$ torr) at $t = 750°C$. It is shown that significant changes of the phase composition of alloys investigated occur during the oxidation process. The formation of a solid solution of oxygen in the compound Zr_2Fe, a solid solution of iron in hydrides of the type ZrH, α-iron, and the compound Fe_3O_4 has been detected. The quantity of iron in these compounds for various periods of oxidation has been determined. To determine the quantity of resonance iron atoms in magnetic phases a modification of the Bykov and Fam Zui Khien procedure was used in which instead of the parameter κf the parameter $\kappa(f)ef \simeq 3\kappa f$, determined for magnetic materials, is incorporated. (auth)

7787 COMPOSITION OF ETA CARBIDE PHASE IN 2¼ Cr–1 Mo STEEL. Leitnaker, J. M.; Klueh, R. L.; Laing, W. R. (Oak Ridge National Lab., TN). Metall. Trans., A; 6A: No. 10, 1949-1955(Oct 1975).

The metal-to-carbon ratio in the eta phase in 2¼ Cr–1 Mo steel exposed to sodium at 566°C for 26,500 h, and probably under a variety of service conditions, approaches four, rather than six, a fact which may be influenced by the presence of Si, O, and perhaps Cr. Silicon is present in the eta phase, probably on a metal sublattice, while oxygen is probably present on the metalloid sublattice. The observation is supported by both structural and compositional data from the literature. (auth)

7788 STABILITY OF SOME METALS IN MOLTEN SODIUM METAPHOSPHATE. Casey, E. J.; Dubois, A. R.; Gorman, R. W. (Defence Research Establishment, Ottawa). Corrosion; 31: No. 10, 358-363(Oct 1975).

From meeting on corrosion; Chicago, IL, USA (1974).

The possibility of dried molten sodium metaphosphate as electrolyte and oxidant in electrochemical cells has been examined experimentally. New results on the resistance of zirconium and Zircaloy-2 to corrosion and to anodic dissolution are given. The behavior of titanium and several other metals, copper, iron, and especially nickel, is presented as well. Calcium behaves differently, as does platinum. Cells of the general type M_1/molten $NaPO_3/M_2$ are discussed from the point of view of possible anodes, cathodes, and container materials in electrochemical reactors. (auth)

7789 STRESS CORROSION CRACKING OF Ti–8Al–1Mo–1V IN MOLTEN SALTS. Smyrl, W. H. (Sandia Labs., Albuquerque, NM); Blackburn, M. J. Corrosion; 31: No. 10, 370-375(Oct 1975).

From international conference on stress corrosion mechanisms in titanium alloys; Atlanta, GA, USA (Feb 1975).

The stress corrosion cracking (SCC) behavior of Ti–8Al–1Mo–1V has been studied in several molten salt environments. Extensive data are reported for the alloy in highly pure LiCl–KCl. The influence of the metallurgical heat treatment and texture, and the mechanical microstructure show similarities with aqueous solutions at lower temperature. The fracture path and cracking modes are also similar to that found in other environments. The influence of H_2O and H^- in molten LiCl–KCl led to the conclusion that hydrogen does not play a major role in crack extension in this environment. (auth)

Preparation and Fabrication

7790 (AED-CONF-75-170-009) PRODUCTION AND PROPERTIES OF Nb_3Sn MULTINUCLEAR CONDUCTORS. Ervens, W. (Krupp (Friedr.) G.m.b.H., Essen (F. R. Germany). Forschungsinstitut). 1975. 7p. (In German). INIS.

From general meeting of the Deutsche Gesellschaft fuer Metallkunde; Nuernberg, F. R. Germany (20 May 1975).

8 figs.; 3 refs. With abstract.

Starting with special arrangements of the elements copper, niobium, and tin which are brought to the desired diameter by compound drawing, multinuclear conductors with Nb_3Sn are obtained after annealing for 1 to 150 h at temperatures from 650 to 850°C. The current-field characteristics of some conductors were determined at 4.2°K up to 14.5 Tesla. The dependence of the critical currents on a bending stress of the wires was investigated. (auth)

7791 (CONF-751012-7) ADVANCES IN STAINLESS STEEL WELDING FOR ELEVATED TEMPERATURE SERVICE. Goodwin, G. M.; Cole, N. C.; King, R. T.; Slaughter, G. M. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. 11p. Dep. NTIS $4.00.

From SME/ERDA welding and joining workshop; Chicago, Illinois, USA (28 Oct 1975).

An extensive program to characterize the microstructures and determine the mechanical properties of stainless steel welds is described. The amount, size, shape, and general distribution of ferrite in the weld metal was studied. The effects of electrode coatings on creep-rupture properties were determined as were the influences of slight differences in analyzed contents of carbon, silicon, phosphorus, sulfur, and boron. Using the above information, a superior commercially produced electrode was formulated which took advantage of chemical control over boron, titanium, and phosphorus. This electrode produced deposits exhibiting superior mechanical properties and it was successfully utilized to fabricate a large nuclear reactor vessel. (auth)

7792 (CONF-751012-9) MECHANIZED WELDING IN A GLOVE BOX. Pugacz, M. A.; Walker, D. E. (Argonne National Lab., Ill. (USA)). Oct 1975. Contract W-31-109-Eng-38. 6p. Dep. NTIS $4.50.

From SME/ERDA welding and joining workshop; Chicago, Illinois, USA (28 Oct 1975).

An orbital-tungsten-arc welding gun was installed in a helium glove box to automatically weld final end closures to capsules that were to contain an atmosphere of required composition and quality. A fixture, tooling, and procedures were developed to automatically position the tungsten electrode repetitively with respect to the end of the tube to be welded closed. (auth)

7793 (ORNL-TM-5163) BEHAVIOR AND PROPERTIES OF WELDED TRANSITION JOINTS BETWEEN AUSTENITIC STAINLESS STEELS AND FERRITIC STEELS: A LITERATURE REVIEW. King, J. F. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 16p. AT.

Concerns and failures associated with dissimilar-metal transition joints in a nuclear system such as the LMFBR have been sufficient to prompt several investigations of the problem over the last two to three decades. A review of the literature shows that the generally accepted method of making transition joints between austenitic and ferritic steels for high-temperature cyclic service is to use nickel-base filler metals. Despite the apparent satisfactory histories of transition joints welded in this manner, a reasonable doubt remains about the appropriate design criteria and fabrication procedures for a welded joint that will reliably operate for a lifetime of 300,000 h. (16 references) (DLC)

7794 (RFP--2233) CHARACTERIZATION OF BRAZING ALLOYS WITH STAINLESS STEELS. Riefenberg, D. H.; Doyle, J. H.; Hillyer, R. F.; Bennett, W. S. (Atomics International Div., Golden, Colo. (USA)). 19 Sep 1975. Contract E(29-2)-3533. 30p. Dep. NTIS $4.00.

To simulate braze joints, qualitative x-ray mapping of the elemental interactions between brazing alloys and two common types of stainless steels was performed via the electron microprobe. In general both steels, Types 304L and 21-6-9, react with a particular brazing alloy in a similar manner, the exceptions being the gold–copper brazing alloys which show deeper penetration into the 21-6-9 stainless steel. (26 figures) (auth)

7795 (UCRL-51916) DIAMOND-TURNING HP-21 BERYLLIUM TO ACHIEVE AN OPTICAL SURFACE. Allen, D. K.; Hauschildt, H. W.; Bryan, J. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Sep 1975. Contract W-7405-eng-48. 62p. Dep. NTIS $5.45.

Investigation of diamond turning on beryllium was made in anticipation of obtaining an optical finish. Although results of past experiences were poor, it was decided to continue diamond turning on beryllium beyond initial failures. By changing speed and using coolant, partial success was achieved. Tool wear was the major problem. Tests were made to establish and plot wear as a function of cutting speed and time. Slower speeds did cause lower wear rates, but at no time did wear reach an acceptable level. The machine, tools, and procedure used were chosen based on the results of preliminary attempts and on previous experi-

ence. It was unnecessary to use an air-bearing spindle because tool failure governed the best finish that could be expected. All tools of diamond composition, whether single crystal or polycrystalline, wore at unacceptable rates. Based on present technology, it must be concluded that beryllium cannot be feasibly diamond turned to achieve an optical finish. (22 fig.) (auth)

7796 (Y-DA--6345) JOINT DESIGN FOR WELDING THIN MATERIALS. Scott, D. G. (Oak Ridge Y-12 Plant, Tenn. (USA)). 1975. Contract W-7405-eng-26. 9p. Dep. NTIS $4.50.

Techniques were developed for making leak-tight welds in 0.254-to-0.508-mm-thick Type 304L stainless steel or other sheet-metal containers. Inexpensive sheet-metal forming equipment is used to obtain a tight-fitting lap joint which makes a gas tungsten-arc weld possible without the aid of backing materials. Techniques used in making a butt weld in 0.254-to-0.508-mm-thick material for enclosure of thick metal parts were also developed. (auth)

7797 ALLOYING OF NICKEL AND COBALT WITH TUNGSTEN BY ELECTROLYTIC PRECIPITATION ON A GRAPHITE FIBER. Yagubets, A. N.; Sherstkina, V. N. Elektron. Obrab. Mater.; No. 5, 31-33(1974). (In Russian)

A study was made of the possibility of even application of Ni–W and Co–W alloys with significant (up to 40%) content of tungsten on a graphite fiber from aqueous solutions of electrolytes. High-quality Ni–W and Co–W coatings are produced on the graphite fibers from an electrolyte containing hydrazine sulfate. Electron microscope and x-ray structural studies show that these coatings, alloyed with small quantities of tungsten, are solid solutions of substitution. The presence of high internal stresses is determined, exceeding the strength of the alloy. The reaction of formation of a yellow-green complex of pentavalent tungsten with thiocyanate was used for quantitative determination of tungsten in the coatings. The tungsten content was established at 10-40%. (JPRS)

7798 USE OF THE METHODS IN THE THEORY OF PLANNING EXPERIMENTS FOR SELECTING THE OPTIMAL CONDITIONS OF ROTATION FORGING OF TUNGSTEN ALLOYS. Pavlov, I. M.; Ushakov, E. V.; Amosov, V. M.; Karavaytsev, V. I.; Zelentsova, N. M.; Shelest, A. E. pp 170-181 of Fizkhim Issled v Metallurgii i Metalloved s Primeneniyem EVM. Moscow; Izdatel'stvo Nauka (1974).

An investigation was made of the dependence of tendency to lamination of a wire of the alloys VAM5 and VAR5 on the thermomechanical conditions of pressure treatment. It was shown that reduction of the forging temperature by 100-150° decreases the amount of defects in the wire from the VAM5 alloy. For VAR5 alloy best results are obtained by increasing at the first stage of forging (to a diameter of 5.3 mm) the temperature of heating the rods to 1600° and reducing the temperature of heating in the diameter range of 5.3-2.25 mm. Positive results were obtained also by decreasing the number of rollers in the rotation forging machine from 12 to 6. (auth)

7799 OPTIMIZATION OF THE THERMOMECHANICAL CONDITIONS OF TREATING TUNGSTEN. Pavlov, I. M.; Ushakov, E. V.; Amosov, V. M.; Karavaytsev, V. I.; Zelentsova, N. M.; Drobysheva, E. K. pp 181-188 of Fiz-khim Issled v Metallurgii i Metalloved s Primeneniyem EVM. Moscow; Izdatel'stvo Nauka (1974).

Influence of the conditions of rotation forging of W type VA on the plastic properties of a wire were investigated. For the parameter of optimization, the authors selected the number of defects of lamination per 1 running meter of 0.3 mm diameter wire. Registration of the defects was accomplished using a DKV-2 type defectoscope. It was found possible to increase the plastic properties of the wire by reducing the forging temperature to 1300°, the use of beacons with an angle of the approach cone of 6 degrees, and also by the use of heating the rods in a C-containing atmosphere. (auth)

7800 INVESTIGATION OF HYDROGEN ADSORPTION BY STEEL DURING ELECTRODEPOSITION OF CADMIUM. Baturin, A. N.; Loshkarev, Yu. M.; Plakhotnik, A. V. (Dnepropetrovsk State Univ., USSR). Prot. Met. (USSR) (Engl. Transl.); 11: No. 1, 107-108(1975).

Translated from Zashch. Metal.; 11: No. 1, 107-109(1975).

The use of polyethylenepolyamine electrolytes makes it possible to obtain corrosion-resistant coatings with widely variable In content (4 to 78%). Effects of current density and electrolyte composition on In content were studied. (DLC)

7801 TEORIIA I TEKHNOLOGIIA SPEKANIIA. (Theory and Technology of Sintering). Samsonov, G. G. Kiev; Izdatel'stvo Naukova Dumka (1974). 320p.

Papers are presented dealing with recent theory of the processes taking place during sintering of powdered metal materials and with experimental investigations of the sintering process. Topics covered include an electron theory of sintering, effects of transition element additions on sintering of tungsten and molybdenum, steady and nonsteady creep during sintering, surface energy and sintering, activated sintering, and a study of the concentration dependence of shrinkage during sintering of two-phase systems. (IAA)

7802 INFLUENCE OF ENVIRONMENT ON KINETICS OF TUNGSTEN SINTERING. Kothari, N. C. (Univ. of Queensland, Brisbane, Australia). pp 124-132 of Theory and Technology of Sintering. Kiev; Izdatel'stvo Naukova Dumka (1974). (In Russian)

The kinetics of the sintering of tungsten powder was studied under various ambient conditions in the temperature range from 1100 to 1600°C. The sintering rate constant was calculated from the dependence of the fractional linear shrinkage on sintering time. Basic mechanism of mass transfer is diffusion along grain boundaries. (IAA)

7803 ASSIMILATION OF RARE-EARTH METALS DURING CONTINUOUS BAR [CASTING]. Tereshchenko, V. T.; Leshchenko, I. P.; Skladnov, Yu. A. Metallurg; No. 1, 20-21(Jan 1975). (In Russian).

The effects of adding rare-earth metals, as ferro-cerium or silico-mischmetal to molten steel in entering (i) the ladle, (ii) the metal stream, the water cooled mold, or in conjunction with slag forming mixtures, were assessed. The assimilation of rare-earth metals into the steel was more effectively achieved by process (ii). (Metals Abstr.)

7804 NEW PROCESS FOR PRODUCING HIGH-PURITY ZIRCONIUM. Ind. Heat.; 41: No. 4, 50-51(Apr 1974).

A prototype electrolytic cell has produced over 20,000 lb of Zr metal of a quality suitable for many of the current applications of the metal. The electrolytic process, however, is inherently less costly than the conventional Kroll process. An engineering study has been initiated to determine the feasibility of a 2.5 million lb/year plant to produce nuclear-grade Zr. Test data indicate that Hf can also be produced in the same system. (Metals Abstr.)

7805 EFFECTS OF NONCONSUMABLE MELTING ON THE QUALITY OF Ti 6Al/4V. Willette, G. D. (Teledyne Titanium, Monroe, NC). J. Vac. Sci. Technol.; 11: 1060-1066(1974).

From vacuum metallurgy conference; Pittsburgh, PA, USA (17 Jun 1974).

A nonconsumable electrode-skull casting process designed to remove refractory inclusions by gravity separation is described. Examples of potential advantages are: (1) All forms of raw materials can be melted in any desired ratio; (2) there is no vaporization and loss of volatile alloy elements, and thus no need for extensive chemical testing and adjustments before remelting; (3) cast remelt electrodes are produced directly, without prior compacting, welding, and consumable melting. With this process, better chemical homogeneity was obtained, and nitride-type as well as high-density inclusions were removed. (auth)

7806 DIFFERENTIAL THERMAL ANALYSIS DETECTS SUPERALLOY REACTIONS. Burton, C. J. (Allegheny Ludlum Industries Co., New Hartford, NY); Boesch, W. J. Met. Prog.; 108: No. 5, 121-124(Oct 1975).

The use of differential thermal analysis (DTA) in establishing optimum melting and casting parameters for superalloys is described. The potential of the differential thermal analysis technique in superalloy technology development is pointed out. The ability to detect low and high volume fraction reactions has great value in explaining the phenomena occurring in these complex systems. Thus, DTA can guide makers and users of superalloys to optimize metallic structures and homogeneity of contemporary superalloys and to stimulate and accelerate design of new superalloys. (JRD)

7807 PRECISION CASTINGS STATE-OF-THE-ART. Nagan, R. M. SAMPE Q.; 6: No. 4, 1-7(Jul 1975).

Over the past ten years the synergistic effects of new technologies, conventional foundry techniques and joint design and casting engineer approaches to new applications have combined to produce a generation of very unconventional castings. Size and complexity capabilities in alloy steels, superalloys, and titanium alloys have advanced into a new transition stage with pour weights of from several hundred to fifteen hundred pounds becoming daily routine and 5,000 pounds capability physically possible this year. Increased customer requirements for guaranteed properties of test bars cut from castings and the consequent need to control microstructure, chemistry, macro, and micro soundness are constantly pushing the state-of-the-art. To meet the demand for larger, more complex castings of high integrity, such long standing sand foundry practices as bottom pour ladles and utilization of ultra hot exothermics have been integrated into the process

along with more sophisticated process control techniques, scaled up mechanized shell molding and melting equipment, and new technologies like hot isostatic pressing. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 7083, 7748, 8432, 8433, 8458, 8689, and 8762.

7808 (AED-CONF-75-170-004) CREEP ANISOTROPY OF ZIRCALOY CLADDING TUBES. Stehle, H.; Steinberg, E. (Kraftwerk Union A. G., Erlangen (F. R. Germany). Reaktortechnik). 1975. 12p. (In German). INIS.

From general meeting of the Deutsche Gesellschaft for Metallkunde; Nuernberg, F. R. Germany (20 May 1975).

11 figs.; 4 refs.

A survey is given on the texture of Zircaloy cladding tubes obtained depending on the manufacturing conditions, and the state of knowledge on the anisotropy of the mechanical properties of the zirconium alloys connected with the texture is outlined Theoretical formulations are set up for the phenomenological representation of the anisotropic creep. The results of tension and compression tests and the thus obtained creep site curves exhibit distinct differences with tubes having different textures. Furthermore, an asymmetry regarding compressive tensile stress is found in such a manner that the material under compression stress is more resistant to creep. Discussions follow on the deformation mechanisms and a comparison with flow processes as well as indications on the significance of these creep results within the framework of fuel rod design are given. (GE)

7809 (AED-CONF-75-170-010) SHORT-RANGE ORDER OBSERVED IN SOLID AND LIQUID Ag–Li ALLOYS BY NEUTRON DIFFRACTION. Ruppersberg, H. (Universitaet des Saarlandes, Saarbruecken (F. R. Germany). Fachbereich Angewandte Physik). 1975. 3p. INIS.

From general meeting of the Deutsche Gesellschaft for Metallkunde; Nuernberg, F. R. Germany (20 May 1975).

2 figs.; 6 refs. With abstract.

By neutron diffraction the same type of short-range order has been observed in solid disordered fcc α Ag-Li alloys and in liquid Ag-Li alloys. (auth)

7810 (ANL-75-55) THERMOPHYSICAL PROPERTIES OF STAINLESS STEELS. Kim, C. S. (Argonne National Lab., Ill. (USA)). Sep 1975. Contract W-31-109-Eng-38. 28p. Dep. NTIS $4.00.

Recommended values of the thermodynamic and transport properties of stainless steels Type 304L and Type 316L are given for temperatures from 300 to 3000°K. The properties in the solid region were obtained by extrapolating available experimental data to the melting range, while appropriate correlations were used to estimate these properties in the liquid region. The properties evaluated include the enthalpy, entropy, specific heat, vapor pressure, density, thermal expansion coefficient, thermal conductivity, thermal diffusivity, and viscosity. (9 fig, 11 tables) (auth)

7811 (CEA-R-4696) ANOMALOUS DIFFUSION IN BODY-CENTERED AND FACE-CENTERED CUBIC METALS. Zanghi, J. P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Div. de Metallurgie et d'Etude des Combustibles Nucleaires). Oct 1975. 204p. (In French). Dep. NTIS (US Sales Only) $8.75.

Thesis. Submitted to Paris Univ., Orsay, France.

Initial rates of contraction due to self-irradiation damage were measured at 4.2°K in three PuSc alloys (5, 12, 18 at. % Sc) stabilized in the fcc δ-phase. The high negative value of the formation volume of a Frenkel pair which is deduced by extrapolating for pure Pu can only be explained by assuming that the interstitial Pu may partly recover its distortion energy by creating bonds with its neighbors, by a localized enhancement of the d.f hybridization and especially by provoking the formation of bonds between its very neighbors. It is shown that about twenty atoms around the interstitial Pu are affected by these bonds. The self-irradiation at 4.2°K of a bcc UPuMo alloy was also studied. Activation volume for self-diffusion of Pu was also determined in bcc PuZr alloys (10 and 40 at.% Zr) in order to check the validity of Nachtrieb's melting-diffusion correlation. Indeed, in the Pu 40 at.% Zr alloy, which has in the pressure–temperature diagram a liquidus of positive slope, a positive activation volume was found, whereas in pure ϵ Pu which has a negative slope, the activation volume is negative. A self-diffusion mechanism in PuZr alloys is proposed. A study of the diffusion of Am in these alloys showed that Am and Pu likely diffuse by the same mechanism. (auth)

7812 (CONF-751209-7) BULK PROPERTIES OF UIr_2 AND UIr_3. Brodsky, M. B.; Trainor, R. J.; Arko, A. J.; Culbert, H. V. (Argonne National Lab., Ill. (USA)). Dec 1975. Contract W-31-109-Eng-38. 7p. Dep. NTIS $4.50.

From 21st annual conference on magnetism and magnetic materials; Philadelphia, Pennsylvania, USA (9 Dec 1975).

The electrical resistivity and magnetic susceptibility of the cubic intermetallic compounds UIr_2 ($MgCu_2$-type) and UIr_3 (ordered, $AuCu_3$-type) were measured between 2-300°K. The susceptibility of UIr_3 is temperature independent and substantially lower than that of isoelectronic URh_3, being 0.57 vs 0.97 x 10^{-3} emu/mole at room temperature. The susceptibility of UIr_2 is very weakly temperature dependent above 100°K and has a value of 1.18 x 10^{-3} emu/mole at room temperature. The electrical resistivities of both compounds follow power law dependences at low temperatures, of the form rho-rho$_0$ equals AT/sup n/, with n equals 1.9 for UIr_2 and n equals 3.7 for UIr_3. These results indicate that UIr_2 may be a spin fluctuation compound, while UIr_3 behaves as a simple transition metal compound, with even less d-f character than URh_3 (n equals 3.0). The specific heat of UIr_2 was measured between 1-4K and may be fit to C equals gamma T + beta T^3, with a large value of gamma, 62.5 mJ/ (mole-K^2), which is consistent with a narrow 5f band at the Fermi level. The lack of any magnetic phenomena in UIr_3 is explained by the hybridization of the 5f electrons into f-d bands, which mostly lie below the Fermi level. (auth)

7813 (CONF-750574-1) HEAT TREATMENT VERSUS PROPERTIES STUDIES ASSOCIATED WITH THE INCONEL 718 PBF ACOUSTIC FILTERS. Smolik, G. R.; Reuter, W. G. (Aerojet Nuclear Systems Co., Sacramento, Calif. (USA)). 24 Feb 1975. 82p. Dep. NTIS $5.50.

From AIME metallurgical society; Toronto, Ontario, Canada (May 1975).

PBF acoustic filter Unit No. 1 cracked when heat treatment was attempted. The effects of prior thermal cycling, solution anneal temperature, and cooling rate from solution anneals were investigated. The investigations concerned influences of the above variables upon both 1400°F stress rupture solution-annealed properties and room temperature age-hardened properties. 1400°F stress rupture properties were of interest to assist the prevention of cracking during heat treatments. Room temperature age-hardened properties were needed to ensure that design requirement would be provided. Prior thermal cycling was investigated to determine if extra thermal cycles would be detrimental to the repaired filter. Slow furnace cools were considered as a means of reducing thermal stresses. Effects of solution annealing at 2000 and 1900°F were also determined. Test results showed that slow cooling rates would not only reduce thermal stresses but also improve 1400°F ductility. A modified aging treatment was established which provided the required 145 ksi room temperature yield strength for the slowly cooled material. Prior cooling did not degrade final age-hardened room temperature tensile or impact properties. (auth)

7814 (COO-1676-37) HYDROGEN STRENGTHENING IN NIOBIUM AND NIOBIUM-BASE ALLOYS. Sagues, A. A.; Ulitchny, M. G.; Gibala, R. (Case Western Reserve Univ., Cleveland, Ohio (USA). Dept. of Metallurgy and Materials Science). 1975. Contract AT(11-1)-1676. 15p. (CONF-750925-7). Dep. NTIS $4.50.

From conference on effects of hydrogen on behavior of materials; Jackson, Wyoming, USA (7 Sep 1975).

This paper discusses solid-solution hardening, precipitate hardening, and alloy softening for Nb and Nb-base interstitial alloys. The effects of these strengthening mechanisms on strain rate sensitivity and ductility are also examined. It is shown that all three strengthening effects involve mainly interaction of dislocations with mobile hydrogen defects and are influenced or caused by residual interstitial solutes. (DLC)

7815 (COO--2172-11) GRAIN BOUNDARY SLIDING AND STRUCTURE. Progress Report, December 1, 1974--November 30, 1975. Li, C. Y. (Cornell Univ., Ithaca, N. Y. (USA). Dept. of Materials Science and Engineering). 1 Sep 1975. Contract E(11-1)-2172. 28p. Dep. NTIS $5.00.

Load relaxation experiments were performed in the region where the grain matrix plastic deformation is important on type 316 stainless steel and a zircaloy specimen, and the data are being analyzed. Anelastic deformation in pure aluminum was investigated. A dislocation glide-controlled anelastic component is identified which may be governed by the same laws as those for plastic deformation at low temperature and/or high plastic strain rate. The investigation of grain boundary sliding in type 316 stainless steel is being continued. Experimental data without the influence of thermal aging are successfully obtained. Load relaxation data on single crystal and polycrystal nickel specimens show that the constant hardness curves of these specimens belong to two different families. The growth of the grain boundary cavity under applied stress and irradiation has been analyzed. It is found that the normal stress at the grain boundary which is the

driving force for atomic transport controlled cavity growth can be relaxed by grain boundary sliding. (auth)

7816 (COO-3084-38) COMBINED MACROSCOPIC AND MICROSCOPIC APPROACH TO THE FRACTURE OF METALS. Technical Progress Report No. 38, July 1974–June 1975. Gurland, J.; Rice, J. R. (Brown Univ., Providence, R. I. (USA)). Jul 1975. Contract E(11-1)-3084. 14p. Dep. NTIS $4.50.

During the report period major studies have been completed on (1) the microscale fracture conditions for the brittle and ductile fracture initiation modes at a macroscopic crack tip, (2) the formulation of dilational plasticity constitutive relations for void containing materials as applied to the inception of ductile rupture, (3) cavity growth during diffusive rupture processes as encountered in creep rupture at low stress but high temperature, and (4) particle and boundary strengthening mechanisms in carbon steels. In addition, work has continued on crack tip modeling by finite elements and mechanisms of ductile void growth near a crack tip. (auth)

7817 (HEDL-TME-75-80) FATIGUE-CRACK PROPAGATION BEHAVIOR OF INCONEL 718. James, L. A. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Sep 1975. Contract AT(45-1)-2170. 63p. Dep. NTIS $4.25.

The techniques of linear-elastic fracture mechanics were used to characterize the effect of several variables (temperature, environment, cyclic frequency, stress ratio, and heat-treatment variations) upon the fatigue-crack growth behavior of Inconel 718 base metal and weldments. Relevant crack growth data on this alloy from other laboratories is also presented. (33 fig, 39 references) (auth)

7818 (LBL-4056) APPLICATIONS OF TIME-DIFFERENTIAL PERTURBED ANGULAR CORRELATIONS TO THE STUDY OF SOLIDS. Schwartz, G. P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1975. Contract W-7405-Eng-48. 120p. Dep. NTIS $6.50.

Thesis.

Time-differential perturbed angular correlation techniques were applied to a systematic study of insulating antiferromagnets and rare-earth intermetallic alloys doped with either /sup 111m/Cd or ^{111}In. The internal magnetic fields and electric field gradients at the radioactive nucleus are deduced from the experimentally measured perturbation factors. The analysis of fluoride, chloride, oxide, and sulfide data shows the systematic variation of the observed supertransferred hyperfine fields with the intervening anion covalency and allows extraction of covalency parameters after the adoption of a simple model. A comparison of the transferred hyperfine field data between fluoride perovskites and the corresponding quadratic layer compounds produces a value for the zero-point spin deviation in magnetically two-dimensional antiferromagnets which is in qualitative agreement with existing theoretical estimates. Paramagnetic shifts due to transferred hyperfine field and field-induced spin-flopping have also been observed. By careful temperature regulation the temperature dependence of the sublattice magnetization can be plotted next to a diamagnetic impurity in $RbMnF_3$ and MnF_2. A shift in the transferred hyperfine field at Cd doped into MnS has been measured under the application of moderate pressures up to 22 kbar. Analysis of the electric field gradients at the In and Sn sites in the rare-earth series RIn_3 and RSn_3 as functions of temperature and pressure is the basis of a check for valence fluctuations in certain of these alloys. (auth)

7819 (ORNL-TM-5110) CANDIDATE CREEP-RECOVERY MODEL FOR 2¼ Cr–1 Mo STEEL AND ITS EXPERIMENTAL IMPLEMENTATION. Robinson, D. N. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 20p. AT.

A uniaxial, creep-recovery model due to R. Lagneborg is recast into a form which facilitates its implementation through a testing program which is entirely phenomenological. The model is being considered under the High-Temperature Structural Design Program at ORNL as a candidate model for 2¼ Cr–1 Mo steel at high temperature. A specific experimental program is proposed for the determination of the several material parameters of the model. Generalization of the uniaxial formulation to that for general states of stress is briefly discussed. (auth)

7820 (ORNL-tr-4021) EFFECTS OF HEAT TREATMENT AND CREEP STRAIN ON THE HARDENING BEHAVIOR STEEL X 8 CrNiMoNb 16 16 IN THE TENSION TEST AT ROOM TEMPERATURE. El-Magd, E. Translated by R. G. Mansfield from Arch. Eisenhuettenwes.; 46: No. 1, 51-56(Jan 1975). 11p. (CONF-7410137–1). Dep. NTIS $4.00.

From meeting of the subgroup for heat-resistant steel; Dusseldorf, F. R. Germany (9 Oct 1974).

Influence of the permanent total set in the creep rupture test at 700°C and 157 N/mm² on tensile strength, yield point, elongation at rupture, and reduction of area at rupture at room temperature was studied for steel X 8 CrNiMoNb 16 16 containing 0.069% C, 17.2% Cr, 16.1% Ni, 1.64% Mo, and about 1% Nb. Comparison was made between hardening in the creep rupture test and in the tension test. Effects of grain boundary deteriorations, influencing the hardening exponent, and effect of solution heat treatment were studied. (auth)

7821 (UCRL-77290) HELIUM RELEASE FROM TYPE 304 STAINLESS STEEL. Cost, J. R.; Hickman, R. G.; Holt, J. B.; Borg, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Sep 1975. Contract W-7405-Eng-48. 23p. (CONF-751026-13). Dep. NTIS $4.25.

From international conference on radiation effects and tritium technology for fusion reactors, Gatlinburg, Tennessee, USA (1 Oct 1975).

Helium in very low concentration (less than 1 atomic ppB) has been introduced into type 304 stainless steel by radioactive decay of dissolved tritium. Release of this helium during subsequent annealing was monitored with a high sensitivity mass spectrometric gas analyzer. With isochronal annealing, helium is released in two temperature ranges, one near 300°C and the other between 800°C and the melting point. The latter release is interpreted as attributable to helium gas bubbles. The release near 300°C was studied isothermally between 150 and 300°C and is analyzed in terms of two stages of exponential decay. The fast and slow release stages have relaxation times near 10^2 and 10^3 s, respectively, and the fast release accounts for roughly 85 percent of the total release at low temperature. From an analysis of the temperature dependence of the release rate, it is concluded that volume diffusion is the controlling mechanism for the outgassing. (auth)

7822 MOESSBAUER STUDIES ON TUNGSTEN ISOTOPES. Gedikli, A. Hamburg; Hamburg Univ. (1973). 49p. (In German). INIS.

Thesis.

A report is given on experiments to determine electric quadrupole moments of tungsten. This is done by evaluations of Moessbauer spectra. The results are compared with hyperfine calculations and Debye-Waller factor determinations and calculations according to the Goldanskii-Karyagin theory. (GE)

7823 ANOMALOUS ABSORPTION OF INTERFERING X-RADIATION IN Ge CRYSTALS AT LOW TEMPERATURES. Ludewig, J. Berlin; Technische Univ. (1973). 144p. (In German). INIS.

Thesis.

Two germanium crystals of different thickness were irradiated with CuKα and CuKβ x-ray light in the symmetrical Laue case and the R_h reflexes 220, 400, 440 were measured at temperatures between 6 and 300°K or 6 and 50°K (440). The measured reflex intensities were mathematically balanced and then used to determine the anomalous absorption coefficients, Debye temperature and the Hoenl-Wagenfeld factor. (GE)

7824 EFFECT OF TITANIUM AND VANADIUM ON FRACTURE, MICROSTRUCTURE, EUTECTIC CELL, AND HARDNESS OF HIGH-PURITY SPECIAL PIG IRON. Kurai, K.; Inoyama, N.; Kawano, Y.; Morita, S. Suiyokaishi; 18: No. 2, 101-110(1974). (In Japanese).

Cast irons containing proportions of Ti and/or V were prepared from pig irons made from Japanese ores, and their fracture, microstructure, eutectic cells, and hardness were studied. Results were: (i) the graphite structure was refined at Ti contents > 0.17%; (ii) V ≯ 1.24% also refined the graphite, and the matrices of all V-containing specimens were fully pearlitic. Ledeburite structures appeared in the range V 0.76 to 1.24%; (iii) in the presence of Ti and V, the effect of Ti on graphite refinement was less marked than when Ti only was present; (iv) hardness decreased at Ti 0.11%, and then increased progressively between Ti 0.17–0.83%. The hardness increased linearly with increase in V; (v) with Ti constant, the hardness increased with V, but with V constant, the hardness decreased with Ti ≯ 0.4%; (vi) Ti increased the eutectic-cell size, but this was decreased by V; and (vii) the white network structure of fractures in cast iron containing Ti were the contour lines of eutectic cells. (Metals Abstr.)

7825 CALCULATION OF THE ELECTRONIC THERMAL CONDUCTIVITY OF SUPERCONDUCTING ALLOYS WITH PARAMAGNETIC IMPURITIES. Leon, B.; Nagi, A. D. S. (Waterloo Univ., Ont.). J. Phys., F (London); 5: No. 8, 1533-1542(Aug 1975).

The reduced electronic thermal conductivity is calculated of a superconducting alloy containing paramagnetic impurities with local states within the gap. Use is made of Green function given by Shiba or Rusinov (for s wave scattering) which is appropriate

for the case when the exchange scattering of a conduction electron from a magnetic impurity is strong. The temperature dependence of (K_s/K_n) is shown for various impurity concentrations and for a typical value of ϵ_0 (= 0.6; ϵ_0 is a parameter which determines the strength of the conduction electron–impurity interaction). Significant deviations are found from the theoretical results based on Abrikosov–Gor'kov theory (ϵ_0 = 1.0). However, the experimental results of Bjerkaas et al. on In–Mn cannot be understood within the Shiba–Rusinov model. (auth)

7826 MECHANISM OF MAGNETIZATION IN MATERIALS $Sm_{0.167}Co_{0.833-x}Al_x$. Oesterreicher, H. (Univ. of California, La Jolla, San Diego). J. Phys., F (London); 5: No. 8, 1607-1618 (Aug 1975).

Magnetization measurements are reported for homogeneous materials $Sm_{0.167}Co_{0.833-x}Al_x$ both in bulk and "oriented powder" form over a temperature range of 1.6 to 280°K with fields up to 45 kOe. The alloys are prepared either by quenching from the melt or with subsequent annealing. X-ray diffraction indicates that specimens which had been quenched from the melt exhibit stacking faults in the basal plane. Substitution of Al for Co in $SmCo_5$ results in an increase in the anisotropy field, H_a, at all temperatures investigated. At 4.2°K, outstanding magnetic hardness is found in both the Al-rich powder and the bulk specimen, with coercive forces, H_c, of order 40 to 50 kOe compared with values of 1 and 10 kOe for $SmCo_5$ in bulk and powder form respectively. This magnetic hardness decays with temperature according to a Curie-type law. It is inferred from these findings that the domain wall energy increases strongly on Al substitution. Moreover, when Al is substituted for Co, the predominant mode of domain reversal changes at cryogenic temperatures from a mechanism involving domain wall nucleation to one of domain wall pinning. This domain wall pinning, particularly in the annealed specimen, appears to have the character of an intrinsic homogeneous pinning on the crystal lattice of domain walls of atomic dimensions. The mechanism of magnetization in highly energetic domain wall materials is shown to reflect in a delicate way details of structure on an atomic scale. Preliminary results are presented for alloys Sm_2Co_{17} and Sm_2Co_7 with Al substitution for Co. Experiments on analogous alloys incorporating Y and Gd are reported. An exploratory effort at coating $SmCo_5$ powders with its Al substituted derivatives is described. (auth)

7827 STRUCTURAL AND MAGNETIC PROPERTIES OF PSEUDOBINARY PHASES IN THE YTTRIUM-3D TRANSITION METAL PHASE DIAGRAMS. Taylor, K. N. R.; Poldy, C. A. (New South Wales Univ., Kensington, Australia). J. Phys., F (London); 5: No. 8, 1593-1606 (Aug 1975).

Magnetic and structural properties were examined for pseudobinary compounds of many stoichiometries and solubility ranges in the phase diagrams defined by Y(Fe, Co) and Y(Co, Ni). Attempts were made to account for the disappearance of certain phases in terms of atomic substitution and changes in the electron concentration. The magnetic behaviour is related to that of the alloys of the pure metals Fe, Co, and Ni; however, a deep minimum is found to occur in the molecular moment in several stoichiometries near to the nickel compound. There is also a corresponding minimum in the exchange interaction strength. The observations may be understood in terms of an analysis involving the form of the density of states curves in these materials. (auth)

7828 MOESSBAUER EFFECT AND MAGNETIC PROPERTIES OF SOME Eu–Zn COMPOUNDS. Buschow, K. H. J. (Philips Gloeilampenfabrieken N. V., Eindhoven, Netherlands); Huiskamp, W. J.; LeFever, H. T.; van Steenwijk, F. J.; Thiel, R. C. J. Phys., F (London); 5: No. 8, 1625-1636(Aug 1975).

The Eu Moessbauer effect was studied in the compounds $EuZn_{13}$, $EuZn_5$, and $EuZn_2$ at various temperatures. The hyperfine fields and the isomer shifts were determined. For these compounds, the lattice constants and the magnetic properties were also studied: $EuZn_{13}$ is ferromagnetic, $EuZn_5$ antiferromagnetic, and $EuZn_2$ metamagnetic. The ordering temperatures, asymptotic Curie temperatures, and effective moments were determined. It was established that the Eu in these compounds is almost completely in the divalent state, isoelectronic with Gd. Data for $EuZn_2$ were used to analyze the strength of the magnetic coupling between the localized moments by means of the RKKY model. The sign and magnitude of the s-f exchange integral were determined. (auth)

7829 FATIGUE CRACK PROPAGATION IN A TYPE 316 STAINLESS STEEL WELDMENT. Pickard, A. C.; Ritchie, R. O.; Knott, J. F. (Cambridge Univ., Eng.). Met. Technol.; 2: No. 6, 253-263 (Jun 1975).

The relationship between fatigue crack propagation rate per cycle da/dN and the variation in stress intensity ΔK has been studied for the material in and around a submerged arc weld in an austenitic stainless steel of Type 316L composition. The behavior observed is correlated with the microstructure of the material, and with the fracture surfaces obtained. (auth)

7830 MAGNETIC PROPERTIES OF ALLOYS OF Rh WITH LANTHANIDES. Loebich, O. Jr.; Raub, E. (Forschungsinstitut fuer Edelmetalle und Metallchemie, Schwaebisch, Ger.). Mater. Res. Bull., 10: 1017-1022(Oct 1975). (In German)

A complete series of Gd–Rh alloys and several Rh alloys of Dy and Ho exhibit Curie–Weiss type of paramagnetism having the effective moments of the tripositive Ln-ions whereas Y–Rh alloys show Pauli paramagnetic behavior. Low field antiferromagnetic ordering is observed at 115°K for Gd_3Rh as compared with the structural anisotropic Néelpoint at 142°K for Gd_7Rh_3. (auth)

7831 DYNAMIC CRACK PROPAGATION. Proceedings of an International Conference, Bethlehem, PA, July 10–12, 1972. Sih, G. C. (ed.). Leiden; Noordhoff International Publishing (1973). 733p. (CONF-720709-).

Papers presented at the conference are concerned with microfracture, brittle materials and glass, ductile materials, dynamic crack models, continuum experiments, analytical crack problems, and structures. A separate abstract was prepared for each of five papers. One item has been announced in Nuclear Science Abstracts and the five items have been announced in ERDA Research Abstracts. (JRD)

For an abstract of an individual paper see: 7738.

7832 INVESTIGATION INTO THE EFFECT OF YTTRIUM ON THE STRUCTURE OF CAST IRON. Andreev, A. P.; Izmailov, V. A.; Smirnov, K. V.; Kashin, V. I. Liteinoe Proizvod.; 8: 24-25(Aug 1974). (In Russian)

The structure of cast iron containing C 2.87 to 3.95% was examined by metallography and microhardness in specimens after diffusion impregnation with Y at 1450°C, cooling at 100 to 110°C/min to the eutectic temperature and cooling at 70 to 80°C/min to the eutectoid temperature. The minimum hardness was observed with 0.05 to 0.10% residual Y. With Y content >0.15% a plate-like eutectic was formed. The coefficient of Y diffusion at 1450°C was (2.7 to 3.8) $\times 10^{-5}$ cm^2/s and was independent of the C content. (Metals Abstr.)

7833 STRUCTURE OF THE SURFACE LAYER AND THE PROPERTIES OF CREEP RESISTANT METAL OPERATING IN OXIDIZING ENVIRONMENTS. Filatova, M. A. pp 77-80 of Vliyanie Fiz.-Khim. Sredy na Zharoprochnost Metal. Materialov. Moscow; Izdatel'stov Nauka (1974).

Alloying to raise the efficiency of creep-resistant alloys was studied, with particular reference to gas turbine blades. Combined Nb + Co alloying of such Ni-base alloys reduced the rates of oxidation, and the denudation of the surface layers of elements that form the $Ni_3(Al, Ti)$ strengthening phase in currents of fuel combustion products at 800–850°C. Nb + Co alloying significantly alters the alloy structure, which it stabilizes during conditions of service; it also improves both the short- and long-term strength characteristics. (Metals Abstr.)

7834 INFLUENCE OF MICROADDITIVES OF CERIUM, VANADIUM, AND BORON ON THE PROPERTIES AND WELDABILITY OF HEAT-STRENGTHENED STEEL. Kroshkin, V. A.; Rubenchik, Yu. I.; Medinskaya, I. P.; Zherdev, A. V.; Glebova, V. S.; Zandenberg, S. A. Tekhnol. Organ. Proizvod.; No. 11, 33(1974). (In Russian)

Investigations were made of well deformed heat-strengthened steel 10G2FR intended for important structures, including containers under pressure operating at temperatures to –70°. V ensures strengthening of the steel and resistance to softening during annealing, B effectively increases the annealability, and Ce improves the plasticity and ductility at negative temperatures. The optimal composition and modes of heat strengthening were worked out for the 10G2FR steel which ensure the required stable mechanical properties at thicknesses of 10–50 mm. (Ref. Zh.)

7835 PRECIPITATION AND THERMOMECHANICAL BEHAVIOR OF NICKEL-RICH NICKEL-NIOBIUM AND NICKEL-TITANIUM ALLOYS. Hotzler, R. K. Brooklyn; Polytechnic Inst. of New York (1975). 229p. University Microfilms Order No. 75-21,366.

Thesis (Ph. D.).

The precipitation and thermomechanical behavior of both nickel-rich nickel-niobium and nickel-titanium alloys were studied. Because of their inherent strength and corrosion resistance these binary alloys provide a basis for many commercial high temperature alloy systems; however their precipitation and thermomechanical behavior are still not fully understood. The study was conducted to clarify the strengthening mechanisms operative in these binary alloy systems. The precipitation kinetics were established in both binary systems by means of a magnetic analysis technique which, by measuring Curie temperatures was used to

ascertain changes in the solute content of the matrix phase upon aging. Microstructural changes were observed by means of both optical and electron microscopy while both hardness and tensile tests were employed to evaluate mechanical property changes. The magnetic calibration experiments carried out on the nickel-niobium alloys established a linear relation between the ferromagnetic Curie temperature and the concentration of niobium in solid solution with nickel. The relation can be expressed as, W/ sub Nb/ equals 17.13 - 0.02587 theta/sub c/, where "W/sub Nb/" represents the weight percent niobium in solid solution and "theta/sub c/" the Curie temperature in ^{0}K. In the case of the nickel-titanium alloys the following linear relation was established between the ferromagnetic Curie temperature and the concentration of titanium in solid solution with nickel: W/sub Ti/ equals 11.82 - 0.0175 theta/sub c/, where "W/sub Ti/" represents the weight percent titanium in solid solution and "theta/sub c" represents the Curie temperature in ^{0}K. (Diss. Abstr. Int., B)

7836 SUPERCONDUCTIVITY AND THE KONDO EFFECT IN QUENCH-CONDENSED FILMS CONTAINING CERIUM. Delfs, R. J. Ames, IA; Iowa State Univ. (1975). 120p. University Microfilms Order No. 75-17,386.

Thesis (Ph. D.).

The superconducting transition temperature, T/sub c/, and the Kondo resistance anomaly were studied in flash-evaporated quench-condensed thin films of Pb(Ce) and In(Ce). In both alloys, cerium caused a uniform depression of T/sub c/, with a slope of 1^{0}K/at. percent Ce. Measurements after low temperature annealing and measurements on samples of different residual resistivities, rho_0, showed T/sub c/ to be relatively insensitive to structural disorder. Approximately half of the samples showed a Kondo effect with a resistivity rise proportional to log T at low temperatures. For the In(Ce) system the rise in resistivity over one temperature decade, DELTA rho, equalled .03 mu OMEGA cm/at. percent Ce relatively independent of structural disorder. For the Pb(Ce) system, however, DELTA rho equals 3 mu OMEGA cm/at. percent Ce for disordered films having rho_0 equals 400 mu OMEGA cm, but DELTA rho equals .015 mu OMEGA cm/at. percent Ce for films having rho_0 equals 100 mu OMEGA cm. Similar decreases of DELTA rho with rho_0 were also observed after low temperature annealing of the films. Calculations of the superconducting state scattering time, tau/sub s/, and the normal state Kondo scattering time, tau/sub m/, showed that for In(Ce), tau/sub m/ and tau/sub s/ were both approximately equal to 5×10^{-12} seconds. For the Pb(Ce) system, however, tau/sub s/ was approximately 8×10^{-12} seconds whereas tau/sub m/ ranged from 4×10^{-14} seconds to 8×10^{-12} seconds. The result that tau/sub s/ much greater than tau/sub m/ for a sizable fraction of the Pb(Ce) films may signify that the onset of superconductivity greatly depresses the scattering associated with the Kondo effect. (Diss. Abstr. Int., B)

7837 TUNNELLING DETERMINED SUPERCONDUCTING ENERGY GAP OF BULK SINGLE CRYSTAL ALUMINUM. Civiak, R. L. Pittsburgh; Univ. of Pittsburgh (1974). 86p. University Microfilms Order No. 75-18,231.

Thesis (Ph. D.).

A procedure has been developed for fabricating Glaver tunnel junctions on bulk aluminum. Al-I-Ag junctions were prepared, where I is the naturally formed oxide on the polished, chemically treated aluminum surface. The aluminum energy gap was determined from tunneling conductance curves obtained from samples oriented in three different crystal directions, and as a function of magnetic field in each of these orientations. In contrast to the results of microwave absorption measurements on superconducting aluminum, no magnetic field dependence could be measured for either the average gap or the spread in gap values of the tunneling electrons. This is consistent with commonly accepted tunneling selection rules, and Garfunkel's interpretation of the microwave behavior which depended upon adjusting the energy spectrum of only the electrons traveling parallel to the surface in the presence of a magnetic field. The energy gaps measured for samples oriented in the 100, 110 and 111 directions are 3.52, 3.50 and 3.39 kT/sub c/, respectively. The trend in the anisotropy is the same as in the calculation of Leavens and Carbotte, however, the magnitude of the anisotropy is smaller than in their calculation and that which previous measurements have indicated. (Diss. Abstr. Int., B)

7838 MAGNETIC HARDNESS IN $Sm_{0.167}Co$/sub 0.833-x/Ni/sub x/. Parker, F.; Misroch, M.; Oesterreicher, H. (Univ. of California, San Diego, La Jolla). Mater. Res. Bull.; 10: No. 10, 1075-1078(Oct 1975).

The magnetic hardness of $Sm_{0.167}Co_{0.833-x}Ni$/sub x/ is investigated from 4.2^{0}K to above room temperature. Coercive forces of bulk materials increase at 4.2^{0}K on Ni substitution for Co to values larger than 50 kOe around compositions from x equals 0.4 to 0.6. (auth)

7839 ON FIRST-ORDER STRUCTURAL PHASE TRANSITIONS. II. The Omega Transformation in Zr–Nb Alloys. Cook, H. E. (Univ. of Illinois, Urbana). Acta Metall.; 23: No. 9, 1041-1054(Sep 1975).

The one-dimensional, anharmonic, Landau model for the omega transformation is recalled in a quantitative form for the Zr–20Nb alloy using estimated values for the various force constants. This becomes the starting point for a quantitative examination of the transformation using a previously developed formalism. A negative depression is found in the k-space elastic free energy modulus at a point off-set to higher angles from k/sub omega/, the Bragg peak position for the ideal omega structure. Thermodynamic arguments based on this result suggest that the omega fluctuations are small ellipsoidal wave packets formed by a wave vector off the ideal value k/sub omega/. Good qualitative agreement is found between the measured diffuse intensity of Moss et al. and the fluctuation intensity calculated from the thermodynamic theory. (auth)

7840 COMPOSITION AND TEMPERATURE DEPENDENCE OF THE PARTIAL MOLAR ENTHALPY OF HYDROGEN IN NIOBIUM. Burch, R.; Francis, N. B. (Univ. Whiteknights, Reading, Eng.). Acta Metall.; 23: 1129-1133(Sep 1975).

Pressure-composition isotherms over the temperature range 622 to 1,122^{0}K are presented for the niobium–hydrogen system. From these data the partial molar enthalpy and relative partial molar enthalpy are derived. The partial molar enthalpy is found to vary with temperature, and both enthalpy functions become more negative as the hydrogen content is increased, the variation being about 100 kJ (mole H_2)$^{-1}$. It is shown that these variations in the enthalpy cannot be interpreted solely as an interaction between hydrogen atoms. It is postulated that there is, in addition, an electronic interaction. (auth)

7841 DETERMINATION OF OMEGA PHASE VOLUME FRACTION IN SINGLE CRYSTALS OF BETA TITANIUM ALLOYS. Baggerly, R. G. (Rockwell International, Thousand Oaks, CA). Metallography; 8: No. 5, 361-373(Oct 1975).

Single crystals of metastable bcc Ti–6.5 at. percent Mo alloy have been aged at 350^{0}C for varying times to precipitate the omega phase. The variation in volume fraction of precipitate was determined by a quantitative x-ray diffraction technique and correlated with transmission electron microscopy from thin foils. For Ti–Mo alloys the lattice misfit between omega and beta phases is small; reflections from parallel planes of both phases overlap necessitating the use of reflections from nonparallel planes. The 310 beta reflection and $31\bar{1}1$ and $30\bar{3}2$ omega reflections were selected. These two omega reflections occurred at 96^0 and 105^0 2 theta angles with CuK alpha radiation and required a 14^0 reorientation of the crystal. (auth)

7842 PRELIMINARY FIELD-ION MICROSCOPE STUDY OF GRAIN-BOUNDARY JUNCTIONS IN TUNGSTEN. Nir, N.; Brandon, D. G. (Israel Inst. of Tech., Haifa). Metallography; 8: No. No. 5, 375-390(Oct 1975).

A field-ion microscope capable of operation at up to 80 kV has been used to study grain-boundary junctions in hot-drawn tungsten wire. At the high operating voltages available in this instrument, images of three or more grains and at least one grain-boundary junction were frequently observed. The grain-boundary geometry at the junctions imaged in four separate specimens was analyzed and an estimate made of the relative grain-boundary energies. The relative energies were then correlated with the observed angular misorientations and boundary planes and the results compared with the predictions of the coincidence and 0-lattice models for grain boundaries in single-phase polycrystals. Statistical analysis of the data strongly suggests that an apparently low grain-boundary energy in tungsten can be correlated with specific coincidence relations, although detailed predictions from the models have not been confirmed. (auth)

7843 SURFACE AND VACUUM PHYSICS INDEX. Volume 10, No. 8, 1975. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). vp.

7844 INVESTIGATION OF THE INFLUENCE OF THE KINETICS OF RECRYSTALLIZATION PROCESSES ON THE LONG TIME STRENGTH OF VM-1 ALLOY UNDER CONDITIONS OF THERMOCYCLING. Brik, V. B.; Uskov, E. I.; Fal'chenko, V. M. (Inst. of Strength Problems, Kiev). Strength Mater. (USSR) (Engl. Transl.); 6: No. 11, 1348-1352(Nov 1974).

Translated from Probl. Prochnosti; 6: No. 11, 53-57(Nov 1974).

A study was made of the temperature dependence of the growth rate of recrystallization centers and grains in the Mo-base VM-1 alloy as compared to that of pure Mo and MLT alloy (Mo–0.5% Ti). Temperature limits are established for maintaining the mechanical properties of VM-1. (DLC)

7845 INVESTIGATION OF THE EFFECT OF CHEMICAL COMPOSITION ON THE MECHANICAL PROPERTIES OF ALLOY STEELS USING STATISTICAL METHODS. Savva, S. P.; Il'ichev, V. Ya. Strength Mater. (USSR) (Engl. Transl.); 6: No. 11, 1368-1373(Nov 1974).

Translated from Probl. Prochnosti; 6: No. 11, 70-76(Nov 1974).

In order to obtain specified mechanical properties, statistical methods and a large number of tests are needed. It is shown how experimental data, treated by regression analysis, can be used to choose the main levels and variation intervals in planning the experiments. 900 steels were distributed according to the alloying elements, including Mo, V, W, and B. 34 steels were chosen. Correlation charts are presented for the effects of Mo, V, Co, W, and C on yield strength of the 900 steels. (DLC)

7846 INVESTIGATION INTO THE FATIGUE STRENGTH OF MLT-1 MOLYBDENUM ALLOY AND ITS WELDS. Gal'perin, M. Ya.; Glazunov, M. G.; Danyushchenkov, I. A.; Solodkov, A. I.; Yakushina, A. I. Strength Mater. (USSR) (Engl. Transl.); 6: No. 11, 1383-1388(Nov 1974).

Translated from Probl. Prochnosti; 6: No. 11, 85-90(Nov 1974).

An assessment was made of the fatigue strength of MLT-1 (Mo-0.5% Ti) alloy and its welded joints under static and cyclic load; a metallographic investigation was made of the zones which suffered fatigue damage or failed. The material was in the cold-hardened condition or annealed condition. (DLC)

7847 PROBLEM OF PREDICTING THE LONG TIME MECHANICAL PROPERTIES ON THE BASIS OF THE SHORT TIME. Krivenyuk, V. V. (Inst. of Problems of Strength, Kiev). Strength Mater. (USSR) (Engl. Transl.); 6: No. 12, 1463-1469(Dec 1974).

Translated from Probl. Prochnosti; 6: No. 12, 40-47(Dec 1974).

Prediction of long-time strength of heat-resistant steels and alloys is considered. Data from short-time and long-time tests are plotted for representatives of 12 material classes. Correlations are given between the short-time and long-time tensile strengths, and the ductility. (DLC)

7848 ANOMALOUS GROWTH IN PLASTICITY IN STABLE AND METASTABLE AUSTENITIC STEELS. Voitselenok, S. L.; Lysyak, A. V.; Burnos, V. A. (All-Union Tube Scientific-Research Inst., Dnepropetrovsk, USSR). Strength Mater. (USSR) (Engl. Transl.); 6: No. 12, 1529-1531(Dec 1974).

Translated from Probl. Prochnosti; 6: No. 12, 105-107(Dec 1974).

Anomalous changes in plastic properties according to deformation temperature occur with changes in percentage elongation, reduction of area, and impact strength, i.e., in deformation with various stress-state patterns. The temperatures, at which plastic properties begin to grow and reach their maxima, fall as stability of austenite increases. The anomalous growth in plasticity at various deformation temperatures may be utilized in the manufacture of formed products, particularly tubes, in stainless steels. The data obtained can be used as a basis for calculating optimum temperature conditions for rolling steels EH1711, 000Kh18N12, and EH1847 (3% Mo) with various degrees of deformation. (auth)

7849 RESISTANCE TO FRACTURE OF A ZIRCONIUM ALLOY CONTAINING 2.5% Nb. Vasnin, A. M.; Gol'tsev, V. Yu.; Markochev, V. M.; Rivkin, E. Yu. (Moscow Engineering-Physics Inst.). Strength Mater (USSR) (Engl. Transl.); 6: No. 12, 1535-1539(Dec 1974).

Translated from Probl. Prochnosti; 6: No. 12, 111-115(Dec 1974).

Results are given of a study of the fracture resistance of Zr-2.5% Nb sheets and tubes in the initial state under static loading. For the sheets, the nominally elastic stresses when the crack is displaced in most cases exceed the yield point, and considerable plastic deformation occurs before crack movement. The tube results are given in the form of hoop stresses vs half-length of initial notch. This relation can be used to calculate the fracture resistance of Zr-2.5% Nb tubes with stresses up to 0.8 $\sigma_{0.2}$ and 20-70 mm cracks. (DLC)

7850 INFLUENCE OF INTERSTITIAL HYDROGEN ON HALL VOLTAGE AND ON ELECTRIC RESISTANCE OF THIN ZIRCONIUM FILMS. Bastl, Z. (Inst. of Physical Chemistry and Electrochemistry, Prague). Collect. Czech. Chem. Commun.; 40: No. 7, 1987-1996(Jul 1975).

Results on Hall voltage changes of thin zirconium films and electric resistance changes of zirconium films and filaments are reported for hydrogen absorption over the atomic ratio region $0 < H/Zr < 1.8$. The Hall coefficient of thin films and the electric resistance of zirconium filaments reach the maximum values in the region of the atomic ratio $H/Zr \approx 1.6$, where the precipitation of the ϵ-phase of hydride occurs according to the phase diagram of the studied system. However, the character of variation of the electric resistance of the thin films during hydrogen sorption is qualitatively different from the character of variation of the resistance of the zirconium filaments. This difference is presumably due to the microcrystalline structure of thin films, which affects the distribution of the particular phases of hydride in the film, and due to the expansion of crystal lattice of the metal during hydrogen dissolution. The application of phase diagrams to thin hydride films as well as the utilization of the results of the electric resistance and the Hall voltage changes for obtaining information on phase composition are discussed. (auth)

7851 EFFECT OF THE MICROPOROSITY ON THE RECRYSTALLIZATION AND THE HIGH TEMPERATURE CREEP STRENGTH OF TUNGSTEN WIRES. Horacsek, O. Acta Tech. Acad. Sci. Hung.; 78: No. 3/4, 355-370(1974).

The effect of microporosity associated with additions of K, Si, and Al on the recyrstallization and the high-temperature creep strength of powder-metallurgical W wires was studied. K bubbles arranged in rows parallel to the wire axis contribute to the formation of grain structure which improves the mechanical properties of the wires. However, the presence of the bubbles, which act as cavity nuclei, can cause intercrystalline rupture. (Metals Abstr.)

7852 EFFECT OF GRAIN BOUNDARY STRENGTH ON THE MECHANICAL PROPERTIES OF TUNGSTEN. Bartha, L.; Varga, L.; Nagy, A. Acta Tech. Acad. Sci. Hung.; 78: No. 3/4, 343-354(1974).

The effect of grain boundary strength on the mechanical properties of W bars and wires was investigated. The grain boundary strength of cold-formed powder metallurgical W bars and wires was low. The low grain-boundary shear strength can result in grain-boundary slip. (Metals Abstr.)

7853 SOME CHARACTERISTIC THERMO-ELECTRIC POWERS IN TUNGSTEN. Uray, L. Acta Tech. Acad. Sci. Hung.; 78: No. 3/4, 435-444(1974).

The thermo-electric characteristics and electrical resistivities of W wires containing various impurity elements were measured. The thermo-electric characteristics W containing Fe, Ni, Pt, Al, Ge, and Mo solute elements and of lattice defects in W were determined by the application of the Nordheim-Gorter rule. (Metals Abstr.)

7854 DIFFUSION OF IRON IN TUNGSTEN LATTICE. Uray, L.; Neugebauer, J. M.; Gaal, I. Acta Tech. Acad. Sci. Hung.; 78: No. 3/4, 393-404(1974).

The bulk diffusion coefficient (D) of Fe in W was determined between 2480 and 3000°K by the rate of evaporation of Fe from powder-metallurgical W wires. An expression was deduced from the experimental data for the temperature dependence of D. The Fe content was determined from the increased resistivity of the W wires. (Metals Abstr.)

7855 SPIN FLUCTUATIONS IN UAl_2 AND $PuAl_2$. Julien, R.; Coqblin, B. J. Phys. (Paris), Lett.; 35: No. 10, L197-L201(Oct 1974).

The thermal dependence of the nuclear magnetic resonance relaxation rate of the Al nucleus in these compounds is explained by a model, involving spin fluctuations for the 5f electrons, previously proposed for resistivity. Account is taken of the temperature dependence of the Stoner susceptibility. (Metals Abstr.)

7856 PHOTO-EMISSION FROM (100) MOLYBDENUM SURFACES. Al Khoury Nemeh, E.; Cinti, R. C.; Hudson, J. B. J. Phys. (Paris), Lett.; 35: No. 10, L179-L180(Oct 1974).

A cylindrical mirror analyzer was used to record spectra of the photo-electrons emitted from an electropolished surface prepared from a single crystal. A cleaned surface in a vacuum of 10^{-9} torr gave peaks at 0.5, -1.7, and -3.5 and a shoulder at -2.9 eV. Surface contamination after a short exposure to residual gas containing CO 20, CO_2 10, and (CH_4 and H) 10% caused the structure near the Fermi level to vanish but even long exposure had little effect on the peaks corresponding to maximum in the density of states. In these respects the behavior is similar to that of the (100) surface of W. (Metals Abstr.)

7857 CONSIDERATIONS ON THE KAUFMAN APPROACH TO BINARY PHASE DIAGRAM CALCULATION. Michaels, K. F.; Lange, W. F. III.; Bradley, J. R.; Aaronson, H. I. (Michigan Technological Univ., Houghton). Metall. Trans., A; 6A: No. 10, 1843-1848(Oct 1975).

The Kaufman approach to phase equilibria involving primarily the fcc, bcc, and hcp phases was examined outside the Group Nos. 4 to 10 range where it is customarily employed. The stability parameters (DELTA H and DELTA S of transformation) for most elements in the Group Nos. 1 to 3 region were found to fit satisfactorily the correlation curves of stability parameter vs group no.; some of the parameters for Al, Be, Mg, and Ti, however, did not. The rare earth parameters fit well in the Group No. 3.5 position they were expected to occupy. A sample phase diagram calculated between two Group 1 elements was in good agreement with

experiment. Phase boundaries of fcc + bcc regions adjacent to terminal solid solutions in several Group 1/Group 2 and Group 1/Group 3 systems, on the other hand, were quite unsatisfactory. This difficulty was traced to the high, positive regular solution constants calculated for both phases. Such constants were shown to result from the downward concavity of a plot of enthalpy of vaporization vs Group No. in the Nos. 1 to 3 region; in the Nos. 4 to 10 range this plot is concave upward. (auth)

7858 STUDY OF THE REACTION KINETICS FOR THE FORMATION OF RARE EARTH: TRANSITION METAL LAVES COMPOUNDS. Deodhar, S. S.; Ficalora, P. J. (Syracuse Univ., NY). Metall. Trans., A; 6A: No. 10, 1909-1914(Oct 1975).

The kinetics of the reaction A/sub (S)/ + 2B/sub (S)/ equals AB/sub 2(S)/ was studied by differential thermal analysis. The A component was Pr, Gd, Dy or Er, the B was Fe, Co, or Ni and the resulting AB_2 compound was a $MgCu_2$ Laves intermetallic compound. A generalized search method to determine the reaction mechanism was developed and applied to the above reactions. The reactions were found to be diffusion controlled and the kinetics best described by the Valensi-Carter equation. (auth)

7859 SPIN–SPIN INTERACTION INTERPRETATION OF RESULTS IN Zn–Mn. Devine, R. A. B.; J. C. H. (Univ. of Montreal). J. Low Temp. Phys.; 21: No. 5/6, 557-566(Dec 1975).

A crystal field interpretation of susceptibility paramagnetic resonance and specific heat results in Zn–Mn is suggested as not consistent and ion–ion interactions are postulated to more readily account for observed behavior. Using a spin–spin interaction model, the exchange was found to be both anisotropic and dependent on more than ion first-nearest-neighbor interactions alone. Cluster contributions are found in both the specific heat and susceptibility. (auth)

7860 THERMAL CONDUCTIVITY OF alpha-PLUTONIUM BETWEEN 3 AND 100 K. Hall, R. O. A.; Lee, J. A.; Mortimer, M. J. (Atomic Energy Research Establishment, Harwell, Eng.). J. Low Temp. Phys.; 21: No. 5/6, 687-706(Dec 1975).

The thermal conductivity of alpha-plutonium was measured over the range 3 to 100°K. For the highest purity material (approximately 50 ppM metallic impurities) a small peak in the conductivity is seen at approximately 10°K, followed by a shallow minimum at 40°K. The maximum measured conductivity is 34.3 mW/K cm at 100°K. A decrease in conductivity occurs at low temperatures as a result of radioactive self-damage, which saturates with an exponential dependence. It is shown that most of the heat conduction is by phonons, electronic thermal conduction being small but rising with temperature. (auth)

Radiation Effects

Refer also to abstracts 8480 and 8722.

7861 (AECL-5042) UNIAXIAL IN-REACTOR CREEP OF ZIRCONIUM–2.5 WT % NIOBIUM AT 570 K. Coleman, C. E.; Causey, A. R.; Fidleris, V. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1975. 14p. Dep. NTIS (US Sales Only) $4.50. AECL $0.50.

Effect of fast neutron flux at 570°K on the creep rate of Zr–2.5% Nb specimens taken from tubes in various metallurgical conditions was investigated, using both constant load tensile creep machines and bent-beam stress relaxation. Creep rates calculated from stress relaxation fit on the trend line for the constant load creep data. Between 114 and 450 MPa, the creep rate is proportional to neutron flux. The creep rate of specimens from the longitudinal direction is about twice that of specimens from the circumferential direction of a tube. This anisotropy in creep strength is attributed partly to crystallographic texture and partly to deformation substructure. Cold-work is detrimental to in-reactor creep strength; as-extruded material has higher creep strength. In cold-worked material at stresses below 100 MPa the stress exponent, n, in $\dot{\epsilon} \propto \sigma^n$ is about 1; n gradually increases with stress, being about 10 at 525 MPa and about 100 at 660 MPa. In laboratory tests, rupture ductility correlates inversely with n; the lower n the higher the ductility. In-reactor tests support this correlation, thus pressure tubes in CANDU (CANada Deuterium Uranium) reactors, operating at 117 MPa where $n \approx 1$, should have good ductility. (6 tables, 9 fig) (auth)

7862 (CONF-751006-13) Ni ION DAMAGE IN Cu AND Nb. Roberto, J. B.; Narayan, J. (Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep. NTIS $4.50.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

Ni ion damage in Cu was studied using x-ray diffuse scattering and transmission electron microscopy, and in Nb using x-ray diffuse scattering. Single crystals of Cu and Nb were irradiated at room temperature to a fluence of $1.2 \times 10^{13}/cm^2$ at 60 MeV, and Cu was also irradiated to $5 \times 10^{12}/cm^2$ at 4 MeV. The x-ray diffuse scattering from loop-type defect clusters in the crystals was measured near several Bragg reflections in order to probe the depth distributions of the damage. In Cu, cluster size distributions derived from the x-ray measurements agreed well with TEM results. Comparison with fission reactor irradiations using the damage energy concept suggests similarities in retained damage between the neutron and Ni ion irradiations. (auth)

7863 (CONF-751006-14) EFFECT OF Be DOPING ON VOID SWELLING IN NICKEL. Okamoto, P. R.; Taylor, A.; Wiedersich, H. (Argonne National Lab., Ill. (USA)). Oct 1975. Contract W-31-109-Eng-38. 9p. Dep. NTIS $4.50.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

Ni–Be alloys containing 0.1, 0.3, and 0.7 at. percent beryllium were irradiated with 3.2-MeV $^{58}Ni^+$ ions at 425, 525, and 625°C. Dose levels between 1 and 30 dpa were obtained at a calculated dose rate of approximately 3×10^{-3} dpa/s. Preliminary transmission-electron microscopy examination of samples irradiated to approximately 17 dpa show that at 525 and 625°C the void volume fraction in the Ni–0.1 at. percent Be alloy is quite similar to that in pure Ni. However, between 0.1 and 0.7 at. percent Be, the void volume fraction decreases by a factor of approximately 40 at 525°C and approximately 3 at 625°C. (auth)

7864 (CONF-751006-16) LOW TEMPERATURE RECOVERY OF RADIATION DAMAGE IN VANADIUM. Klabunde, C. E.; Coltman, R. R. Jr.; Williams, J. M. (Oak Ridge National Lab., Tenn. (USA)). 1975. 8p. Dep. NTIS $4.50.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

Some kind of order may emerge from the numerous anomalies in the low-temperature recovery of irradiated V if it is assumed that Stage I (first recovery by interstitial migration) occurs below 4°K. Present supporting evidence includes: from both thermal neutron and fission neutron damage studies (1) a continuous, nearly structureless recovery from 4 to 43°K independent of dose; (2) a nonlinear, decreasing damage rate at 4°K; and (3) from 6°K electron irradiations near threshold energy there is derived a Frenkel pair resistivity which is so small as to suggest significant loss of defects during irradiation. The assumption of a very low-lying Stage I also helps to explain several other unusual aspects of the data, especially those relating to the sharp recovery peak at 47°K. This is clearly a single first-order process (with a measured activation energy of 0.13 eV), but it has a strong positive dependence of population percentage upon dose, opposite to Stage II impurity detrapping peaks in several fcc metals. Also, the peak has a strong negative dependence upon irradiation temperature when equal doses put in at 4 and 31°K are compared. (auth)

7865 (CONF-751006-18) REPLACEMENT COLLISION SEQUENCES IN METALS. Blewitt, T. H.; Kirk, M. A.; Scott, T. L. (Argonne National Lab., Ill. (USA)). Oct 1975. Contract W-31-109-Eng-38. 20p. Dep. NTIS $4.50.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

The concept of radiation-induced defects traveling large distances by focussed collision sequences (focusons) without thermal activation has important consequences in radiation effect studies. The focussed collision sequences are of two types: (1) "Silsbee focussing" or momentum focussing which can cause defect pairs to form large distances from the primary knock-on and (2) focussed replacement collisions also called "dynamic crowdions" where mass transport causes a large separation between the vacancy and its interstitial. Direct experimental evidence for focussed collision sequences is in short supply and conflicting. The sputtering patterns associated with close packed crystalline directions from the backscattering of charged particles seemed to substantiate long-range focussed collisions until it was pointed out that collision chains need not be long to yield such patterns. More recently, transmission sputtering has been used with conflicting results. Ecker et al. found no evidence for focusons greater than 17 atom distances whereas preliminary results of Siedman et al. suggest several hundred atom distances. Keil and co-workers found evidence for replacement collision sequences of 100 atom distances by stereo electron microscopy of interstitial agglomerates interjected by low energy heavy ion bombardment. Experiments by Kirk et al. and Becker and co-workers on ordered alloys, are only sensitive to dynamic crowdions. Kirk and co-workers result on the changes in magnetic properties of Ni_3Mn induced by thermal neutron bombardment strongly support long range focusons (greater than 30 atom distances) whereas Wollenberger found no evidence for focusons with 1 and 3 MeV electron irradiation. Theoretical treatments of Liebfried suggest a maximum length of 30 atom distances whereas Holmes' modified treatment suggests less than 10 atom distances. (10 fig, 23 references) (auth)

7866 (CONF-751026-6) PRODUCTION OF POINT DEFECTS IN 14.8 MeV NEUTRON-IRRADIATED MgO. Chen, Y.; Abraham, M. M.; Robinson, M. T.; Mitchell, J. B.; Van Konynenburg, R. A. (Oak Ridge National Lab., Tenn. (USA)). Sep 1975. 9p. Dep. NTIS $4.00.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (1 Oct 1975).

High-purity MgO crystals grown at ORNL were irradiated in the LLL 14.8-MeV Rotating Target Neutron Source (RTNS) to doses varying from 1.8×10^{15} to 5.7×10^{17} n/cm^2. The optical absorption spectra of these crystals resembled those irradiated in fission reactors and exhibited bands principally at 4.95, 3.5, 2.2, and 1.3 eV. The band with the largest absorption coefficient, that at 4.95 eV, is due to anion vacancies. The bands at 3.5 and 1.3 eV, attended by zero-phonon lines at 3.430 and 1.187 eV respectively, are attributed to different optical transitions of anion divacancies. The investigations indicate that the net production rates of the point defects resulting from irradiations with 14.8-MeV neutrons are about twice those resulting from fission neutrons in the Oak Ridge Reactor (ORR). This ratio is in reasonable accord with theoretical estimates based on damage energy calculations. (auth)

7867 (CONF-751026-8) 15 MeV NEUTRON DAMAGE IN Cu AND Nb. Roberto, J. B.; Narayan, J.; Saltmarsh, M. J. (Oak Ridge National Lab., Tenn. (USA)). 1975. 17p. Dep. NTIS $4.00.

From international conference on radiation effects and tritium technology for fusion reactors; Gatlinburg, Tennessee, USA (1 Oct 1975).

An investigation was made of high-energy neutron damage in Cu and Nb irradiated with approximately 15 MeV neutrons at the Oak Ridge Isochronous Cyclotron. The neutrons were generated by bombarding a thick Be target with 40-MeV deuterons resulting in a high energy neutron spectrum broadly peaked at 15 MeV. Single crystals of Cu and Nb were irradiated at room temperature to fluences of approximately 2×10^{17} n/cm^2. The resulting loop-type defect clusters in the crystals were characterized using x-ray diffuse scattering and transmission electron microscopy. The cluster size distributions were found to be generally similar to those characteristic of fission neutron irradiations in these materials and no multiple clusters or sub-clusters were observed. Additional comparisons with fission reactor irradiations in Cu and Nb indicate that the retained displacement damage in these crystals is approximately 3 times greater for the high-energy neutrons than for an equivalent fluence of fission neutrons. This result is consistent with detailed damage energy calculations for the Be(d,n) neutron spectrum. (auth)

7868 (COO-3158-45) STUDY OF STAGES I TO IV OF IRRADIATED OR QUENCHED TUNGSTEN AND TUNGSTEN ALLOYS BY FIELD-ION MICROSCOPY. Seidman, D. N.; Wilson, K. L.; Nielsen, C. H. (Cornell Univ., Ithaca, N. Y. (USA)). Sep 1975. 25p. (CONF-751006-17). Dep. NTIS $4.50.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

Progress since 1972 in applying the quantitative field-ion microscope (FIM) technique to the study of point defects in irradiated tungsten and tungsten alloys or quenched tungsten is reviewed. Emphasis was on ascertaining recovery mechanisms for the major recovery stages which are consistent with both other FIM observations as well as observations employing more macroscopic techniques; hence point defect recovery models are presented for recovery Stages I to III. (49 references) (auth)

7869 (HEDL-SA-1036) IRRADIATION CREEP IN THE ABSENCE OF SWELLING. Gilbert, E. R.; Bates, J. F. (Hanford Engineering Development Lab., Richland, Wash. (USA)). 1975. Contract E(45-1)-2170. 11p. (CONF-751051-1; CONF-751101-41). Dep. NTIS $4.50.

From US-German info exchange meeting; Washington, District of Columbia, USA (13 Oct 1975).

In-reactor creep of helium-pressurized 20 percent cold-worked Type 316 stainless steel tubes was investigated at 375 to 575°C. The creep strain was found to be in excess of the thermal creep of unirradiated specimens and the strain rate increased both with temperature and neutron fluence. These results are not clearly predicted by contemporary theories of creep during neutron irradiation. (auth)

7870 (RD/B/N-3413) MODIFICATION OF THE EXISTING YIELDING CREEP THEORY OF IRRADIATION CREEP IN ZIRCONIUM AND ZIRCALOY-2. Madden, P. K.; Hesketh, R. V. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jul 1975. 20p. Dep. NTIS (US Sales Only) $4.50.

The yielding creep model proposed as an explanation of irradiation creep in zirconium and its alloys (Hesketh 1968) was modified to allow for the time dependence of irradiation growth. The modified, predicted time dependence of irradiation creep, is compared with the values determined experimentally by several workers in the field. Good agreement is found for unhydrided zircaloy. However, the present analysis suggests that in zircaloy, preinjected with hydrogen, the time exponent of irradiation growth (which effects the irradiation creep behaviour) increases with increasing hydrogen concentration. (auth)

7871 (RD/B/N-3424) IRRADIATION INDUCED EFFECTS IN ZIRCONIUM (A REVIEW). Part II. Irradiation Creep. Madden, P. K. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Jun 1975. 22p. Dep. NTIS (US Sales Only) $4.50.

Irradiation creep in zirconium and its alloys is comprehensively discussed. The main theories are outlined and the gaps between them and the observed creep behaviour indicated. Although irradiation-induced point defects play an important role, effects due to irradiation-induced dislocation loops seem insignificant. Experimental results suggest that microstructural variations due to prior cold-working or hydrogen injection perturb the irradiation growth and the irradiation creep of zircaloy. One disadvantage of creep experiments lies in their duration. The possibility of accelerated experiments using ion implantation or electron irradiation is examined, and its possible advantages and disadvantages are outlined. (38 references) (DLC)

7872 (SAND-75-5386) ENHANCED DIFFUSION OF Zn IN Al UNDER Ne IRRADIATION. Myers, S. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 7p. (CONF-751006-10). Dep. NTIS $4.00.

From international conference on radiation damage in metals; Gatlinburg, Tennessee, USA (5 Oct 1975).

The diffusion rate of Zn in Al has been enhanced by factors approximately 10^2–10^4 under 80 keV Ne irradiation at 130°C. Diffusion couples were formed by ion implantation of Zn, and the concentration profiles were determined by ion backscattering. The data are analyzed by numerically solving the coupled diffusion equations for vacancies, interstitials and atoms, and by scaling the profiles of vacancy and interstitial production rates from the theoretical profile of Ne energy into atomic processes. The enhanced diffusion rate is linear in flux, indicating that the mobile point defects annihilate predominantly at fixed sinks. The average distance to annihilation is approximately equal to 700 A, except for the first approximately equal to 500 A of the solid where it is much less. Free vacancies and interstitials are found to be created by the Ne at a smaller rate than the atomic displacement rate, suggesting a high annihilation probability within the parent damage cascade. (auth)

7873 (SAND-75-5615) ENERGY DEPENDENCE OF CHANNELING ANALYSIS IN IMPLANTATION DAMAGED Al. Rimini, E.; Campisano, S. U.; Foti, G.; Baeri, P.; Picraux, S. T. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 8p. Dep. NTIS $4.50.

Ion channeling and backscattering measurements along the (110) axis of implantation disorder in Al single crystal are reported as a function of the He analyzing beam energy (0.5-2.0 MeV). For 100-keV N^+ implants (8×10^{16} ions/cm^2), appreciable dechanneling is observed near the end of the projected ion range (2400 A) and the minimum yield increases with decreasing analyzing beam energy. A different behavior was observed for 150-keV Zn^+ implantation into Al with fluences of 6×10^{15} and 1.2×10^{16} ions/cm^2, respectively. The minimum yield in the Zn-implanted region (790 A) shows a root E dependence on the energy E of the analysis beam. These channeling measurements show that the nature of the disorder for light and heavy mass implants in Al is different. The energy dependence of the minimum yield points out that the defects for the N implant are consistent with random scattering centers while for Zn implants extended defects with associated strains, like dislocations, are produced. The energy dependence of the critical angle can also be related to the defect structure. (auth)

7874 (SAND-75-5762) EFFECTS OF ION IMPLANTATION ON AMORPHOUS Gd–Co. Venturini, E. L.; Richards, P. M.; Borders, J. A.; EerNisse, E. P. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 8p. Dep. NTIS $4.50.

Studies of stress, composition, and magnetic properties were made on amorphous Gd–Co thin films implanted with nitrogen ions at fluences between 10^{10} and 10^{16} ions/cm^2. The lateral stress peaks at 2×10^{11} dynes/cm^2 for a fluence of 10^{14} ions/cm^2. Magnetic resonance reveals that the net anisotropy H/sub A/ - 4piM in the implanted layer decreases in the range of 10^{14} to 10^{16} ions/cm^2 and ultimately achieves a negative value considerably larger in magnitude than 4piM in the film prior to the implantation. This

effect can be partly explained by a reduction of Gd content in the implanted layer. But there have to be structural changes as well which alter the microscopic parameters. (auth)

7875 ELECTRICAL MEASUREMENTS OF THE RESISTANCE IN PURIFIED AND NITROGEN-DOPED NIOBIUM AFTER LOW-TEMPERATURE REACTOR IRRADIATION. Keil, D. Stuttgart; Univ. Stuttgart (1973). 118p. (In German). INIS.

Thesis.

Purified niobium wires and wires with a few tens or a few hundreds at. ppM of dissolved nitrogen were irradiated with neutrons at 12 or 19°K in the low-temperature irradiation equipment of the Karlsruhe research reactor FR 2 and were then isochronously annealed up to 700°K. The production and healing of defects were investigated by measuring the electrical resistance. For the exact determination of the healing kinetics, additional isothermal recovery measurements were carried out. The defect production (damage rate) becomes continuously smaller with increasing neutron dose or total concentration of defects; distinct saturation tendencies occur. With small irradiation doses, the fall of the damage rate with defect concentration is steep and curved, at higher irradiation doses (phi $t > 4 \times 10^{17}$ n/cm^2), it is flatter and approximately linear. The total concentration of defects produced increases with increasing nitrogen content; the fall of the damage rate with defect concentration becomes, as a whole, smaller with qualitatively unchanging slope. (GE)

7876 INTERACTION OF DISLOCATION LOOP AND γ' PRECIPITATE IN NICKEL-BASED ALLOYS. Williams, K. R.; Fisher, S. B. (Central Electricity Generating Board, Berkeley, Eng.). Radiat. Eff.; 25: No. 2, 97-103 (1975).

The nucleation and growth of interstitial loops during irradiation has a controlling effect on the subsequent swelling behavior of metals. In nickel-based alloys containing ordered γ' precipitate (Ni_3Al, Ti), interactions occur between the nucleated loops and γ' particles. This effect was studied in two nickel-based alloys using a high voltage electron microscope. For the case of Nimonic 80A alloy containing 18 vol% γ' precipitate, dislocation loop-particle interactions obeyed the developed isotropic elasticity theory. Consequently, rather low dislocation densities were developed and the swelling resistance was high during electron irradiation. In Nimonic 115A alloy, loop nucleation and growth was dependent on the availability of interfacial dislocation surrounding the γ' particles. With regard to the swelling behavior of γ' hardened alloys, it is concluded that several mechanisms contribute to make these materials resistant. (1) Coherency strains at the γ' particles reduce the density of climbing dislocations. (2) The γ' precipitate affects the nucleated dislocations by: (a) pinning the dislocation line, thus introducing a line tension force which opposes dislocation climb and reduces swelling; (b) reducing the available volume of material in which dislocation loops can nucleate and grow. (auth)

7877 EFFECTS OF IRRADIATION AND OXYGEN ON HYDROGEN ENVIRONMENT EMBRITTLEMENT OF SELECTED ALLOYS. Kesterson, R. L. (Offshore Power Systems, Jacksonville, FL). Am. Soc. Test. Mater., Spec. Tech. Publ.; No. 543, 254-263(1974).

From 75th annual meeting and exposition of the American Society for Testing and Materials; Los Angeles, California, USA (25 Jun 1972). See ASTM-STP-543; CONF-720672-.

Testing in 10-MPa hydrogen did not reduce the notched strength of irradiated Inconel 718 or A286; however, irradiated Ti-5Al-2.5Sn suffered reductions in notched strength of 6.9 percent. Likewise, irradiated CW 301 stainless steel lost 81 percent of the notched strength in 10-MPa hydrogen. For hydrogen pressures of 175 kPa, impurity levels of 15-ppM oxygen do not seriously inhibit embrittlement of CW 301 stainless steel and a loss of 42 percent of notched strength is observed. With 150-ppM oxygen, the notched strength is reduced only 7.5 percent. Both Inconel 625 and molybdenum TZM were found to be subject to hydrogen embrittlement. (auth)

7878 SIMULATION OF THE COSMIC CORPUSCULAR RADIATION EFFECTS ON OPTICAL MATERIALS. Akishin, A. I.; Bessonova, T. S.; Prokof'ev, I. P.; Teplov, I. B.; Tokarev, G. A. Tsepliaev, L. I. pp 515-524 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974).

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

Ionization processes induced in optical materials by corpuscular radiation lead to such effects as radioluminescence, radiation coloration, and changes in the elastic properties of optical materials. The effects of corpuscular radiation on the properties of optical materials are studied, using samples of silicate optical glass and of crystalline quartz. The results, given in the form of graphs, are analyzed. (IAA)

7879 RADIATION EFFECTS INFORMATION GENERATED ON THE ASTM REFERENCE CORRELATION-MONITOR STEELS. Hawthorne, J. R. Publication No. DS 54. Philadelphia; American Society for Testing and Materials (1974). 79p.

A survey is made of radiation effects information generated on the first four correlation-monitor materials provided by ASTM to radiation research and reactor surveillance programs. The survey was performed for Subcommittee 2 of ASTM Committee E-10 on Radiation Effects and includes a review of the worldwide distribution and use of the reference materials since 1960. The reference plates were those originally donated to ASTM by the U. S. Steel Corp. Individual plates are identified as 6 in. A302-B steel, 4 in. A212-B steel, 3 in. Ni-Cr-Mo (HY-80) steel and 2 in. T-1 steel. The report presents extensive tabulations of data as provided by the recipient laboratories. In addition, trends in radiation effects behavior with respect to tensile properties, Charpy-V notch ductility properties and postirradiation annealing response are identified and discussed. Nilductility transition (NDT) temperature behavior and dynamic tear (DT) test performance relative to notch ductility behavior are also identified for the A302-B and A212-B reference plates. The report is intended as a reference document for the evaluation and analysis of data developed by on-going reactor vessel surveillance programs and a source for data and data trends by which to assess the performance of new structural steels and to compare the effects of diverse reactor environments. (Metals Abstr.)

7880 DEFECT PRODUCTION IN ALUMINUM DURING ELECTRON IRRADIATION IN A HIGH VOLTAGE ELECTRON MICROSCOPE. Bhatnagar, S. K. Charlottesville, VA; Univ. of Virginia (1975). 174p. University Microfilms Order No. 75-22,167.

Thesis (Ph. D.).

The RCA High Voltage Electron Microscope (with beam energy up to 450 keV/electron) has been used for the study of radiation damage observed in aluminum specimens. Most of the specimens that were investigated were obtained from electrothinning of bulk aluminum sheets about 80 microns thick and irradiated with a 400 keV electron beam. However, some specimens were grown by vacuum deposition. The results obtained for the bulk specimens have been correlated with the gas content of specimens. Also, the effect of surface preparation on development of visible damage has been studied. Bulk specimens which were thinned and annealed for long lengths of time (approximately 15 hours at approximately 400°C in high vacuum at pressures around approximately 10^{-5} mm of Hg) did not develop any significant visible radiation damage for irradiation up to 30 minutes at a beam current of 2.2 A/cm^2. On the other hand, copious damage in the form of black dots developed for unannealed specimens within 15 minutes of irradiation at similar beam currents to the above case. This black-dot damage has been interpreted as interstitial dislocation loops. It is concluded that: (i) the residence time of hydrogen introduced in large amounts during electrolytic thinning of aluminum may be large even at elevated temperatures, (ii) the presence of hydrogen or other relatively mobile gases in aluminum very significantly alters the development of radiation damage in a high voltage electron microscope, and (iii) absence of radiation damage in vacuum deposited aluminum specimens deserves a more detailed investigation. (Diss. Abstr. Int., B)

7881 DEVIATION FROM MATTHIESSEN'S RULE IN ELECTRON-IRRADIATED COPPER. Alldredge, O. R.; DeFord, J. W.; Sosin, A. (Univ. of Utah, Salt Lake City). Phys. Rev., B; 11: No. 8, 2860-2870(15 Apr 1975).

Deviations from Matthiessen's rule (which states that the electrical-resistivity contributions of two different types of scatterers in a metal are additive) occur generally. The deviations arising from relatively simple scatterers: by point defects (vacancies and interstitials) created by electron irradiation and by phonons are examined. Flexibility in the control of point-defect concentrations is the major experimental feature of the work. Deviations from Mattiessen's rule in pure copper were studied over as wide a temperature range as possible, commensurate with the irradiation and annealing schedule used. In particular, the deviations were studied as effected by recovery in the first three major defect annealing stages. When analyzing effects due to stage-I annealing, damage was produced by irradiation at 4°K; in stages II and III, damage was produced at 4 and at 80°K. In all cases, the electron energy was 1.5 MeV. The deviations were analyzed by considering two deviation-producing mechanisms: the two-band model and changes in the temperature-dependent part of the electrical resistivity. At low temperatures (below 35°K) the two-band form explains the data when separate temperature dependences for scattering of neck and belly electrons are taken into account. Contributions due to changes in the temperature-dependent part of the electrical resistivity appeared to play nó substantial part. In the stage-II region the deviations arising from irradiation at 4°K and irradiation at 80°K were of a

similar form, indicating that the nature of the irradiation-induced scatterers in both cases were essentially the same. This may be explained by showing that the interstitials in either case existed as clusters--in the 80°K case, nucleated on impurity traps and, in the 4°K case, self-nucleated. In the stage-III region, contributions to the deviation from changes in the temperature-dependent part of the electrical resistivity were quite large. Similarities between the deviations here and those arising in the neutron-irradiated copper without stage-III annealing give support to the model that the mobile defect in stage III is the vacancy. (auth)

7882 LIMITING STATE OF STRUCTURE-STABLE STEEL UNDER CREEP CONDITIONS FOR INTENSE IRRADIATION. I. Study of the Applicability of Limiting-State Functions to Kh16N15M3B Steel Under Reactor Irradiation Conditions. Kiselevskii, V. N.; Lukashev, V. K.; Kosov, B. D.; Khristov, G. P. (Inst. of Problems of Strength, Kiev). Strength Mater. (USSR) (Engl. Transl.); 6: No. 12, 1470-1474(Dec 1974).

Translated from Probl. Prochnosti; 6: No. 12, 48-52(Dec 1974).

The constants in the equation for the long-term strength were studied for unirradiated and neutron-irradiated Kh16N15M3B steel. Results show that not one of the criteria for long-term strength can be used in algorithms for calculating complex-stressed structural elements exposed to irradiation; it is necessary to develop special functions for the limiting state which take account of the irradiation factor. (DLC)

7883 LIMITING STATE OF STRUCTURE-STABLE STEEL UNDER CREEP CONDITIONS FOR INTENSE IRRADIATION. II. Criteria for the Long-Term Strength of Austenitic Steel Under High-Intensity Irradiation. Kiselevskii, V. N.; Kosov, B. D.; Lukashev, V. K.; Khristov, G. P. (Inst. of Problems of Strength, Kiev). Strength Mater. (USSR) (Engl. Transl.); 6: No. 12, 1475-1478(Dec 1974).

Translated from Probl. Prochnosti; 6: No. 12, 52-55(Dec 1974).

Parameters in the generalized criterion are discussed. The criterion for the long-term strength of irradiated material is solved to a first approximation. The time dependence of this criterion is established for fast neutron-irradiated Kh16N15M3B steel. (DLC)

7884 EFFECT OF NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF WELDS IN A 16:13 CHROMIUM–NICKEL–MOLYBDENUM–NIOBIUM AUSTENITIC STEEL. Solano, R. R.; Hes, G. Rev. Soldadura; 3: No. 3, 125-136(1973). (In Spanish)

Electron-beam of Ar-arc-welded test pieces in an austenitic steel containing C 0.068, Cr 16.14, Ni 13.45, Mo 1.3, Co 0.31, V 0.65, and Nb 0.96% were irradiated by thermal and fast neutrons. Hardness distributions in irradiated and unirradiated sections were compared, and tensile tests carried out at room temperature and 750°C. Results indicate that the effects of irradiation are relatively small. (Metals Abstr.)

7885 $N_{4,5}$ AUGER SPECTRA OF GADOLINIUM. Dufour, G.; Bonnelle, C. J. Phys. (Paris), Lett.; 35: No. 12, L255-L256(Dec 1974). (In French).

By means of LEED methods, the distribution of secondary electrons emitted from a Gd target when bombarded with 2-kV electrons was determined. Peaks are observed at 135, 123, and 105 eV. The results are discussed with reference to the possibility of an auto-ionizing transition, $N_{4,5} \rightarrow N_{6,7}$. (Metals Abstr.)

Other Materials

Refer also to abstracts 6975, 7732, 7761, and 7818.

7886 (AED-CONF-75-056-012) THERMAL ANNEALING OF NEUTRON-INDUCED VACANCIES IN KCl. Felix, F. W.; Heilmann, R.; Mueller, M. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany). Bereich Kernchemie und Reaktor). 1975. 5p. (In German). INIS.

From spring meeting of the Arbeitskreis Festkoerperphysik of DPG; Muenster, F. R. Germany (17 Mar 1975).

5 figs.; 4 refs. With abstract.

The annealing of neutron-induced vacancies in KCl was observed by ion conductivity measurements and F-center spectroscopy. The kinetics of annealing are discussed. With regard to dose dependence, the concentration of anion vacancies was observed to reach a saturation point at a neutron dose of 7.1×10^{16} n/cm², and that of cation vacancies at 5.2×10^{17} n/cm². (GE)

7887 (CONF-751121-1) TESTING OF COATINGS FOR THE NUCLEAR INDUSTRY. Goldberg, G. (Oak Ridge National Lab., Tenn. (USA)). 1975. 23p. Dep. NTIS $4.50.

From southeastern regional meeting of the national association of corrosion engineers; Buena Vista, Florida, USA (9 Nov 1975).

Coatings for commercial nuclear power plants need to withstand humidity, radiation exposure, and LOC accident conditions; they also must be decontaminable. Tests for decontaminability, radiation stability, and design-basis-accident (DBA) resistance are described. An irradiation test facility using spent fuel assemblies and a spray loop for simulating a DBA are described. A sample test report sheet is presented. (DLC)

7888 (COO-2407-3) GENERALIZATION OF INTERNAL CENTRIFUGAL ZONE GROWTH OF METAL-CERAMIC COMPOSITES. Progress Report, December 1, 1974–August 31, 1975. Sekerka, R. F. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)). 1975. Contract E(11-1)-2407. 14p. Dep. NTIS $4.50.

Objectives are (1) to develop a model of Internal Centrifugal Zone Growth (ICZG) and (2) to use this model to improve present ICZG systems. During the present year, models were developed for finite samples heated by finite induction coils. These models enable calculation of two-dimensional temperature profiles in solid samples. Molten zone shapes can be calculated provided that simplified boundary conditions for the rf field are employed. Experiments to test these models were conducted here and at ORNL. The heating instability phenomenon was possibly observed but not quantified. (DLC)

7889 (ORNL-TM--5052) TIME-DEPENDENT DEFORMATION OF CONCRETE UNDER MULTIAXIAL STRESS CONDITIONS. Final Report. McDonald, J. E. (Army Engineer Waterways Experiment Station, Vicksburg, Miss. (USA)). Oct 1975. vp. Dep. NTIS $4.00.

For Oak Ridge National Lab., TN.

An investigation was made on the time-dependent deformation behavior of concrete in the presence of temperature, moisture, and loading conditions similar to those encountered in a prestressed concrete reactor vessel (PCRV). This investigation encompassed one concrete strength (6000 psi at 28 days), three aggregate types (chert, limestone, and graywacke), one cement (Type II), two types of specimens (as-cast and air-dried), two levels of temperature during test (73 and 150°F), and four types of loading (uniaxial, hydrostatic, biaxial, and triaxial). This effort was intended primarily as a data report; the experimental procedures and results are presented in detail. A comprehensive evaluation of the effects of various parameters and their interactions on the behavior of concrete is not included. However, a number of general comparisons were made concerning the effect of the various test conditions on concrete behavior. Based on this limited evaluation of the data, general conclusions and recommendations for additional work were formulated. (auth)

7890 (ORNL-TM--5100) TECHNIQUE FOR DIFFERENTIATING BETWEEN OPEN AND CLOSED PORES ON A MICROSCOPIC SCALE. LaValle, D. E.; Costanzo, D. A.; Lackey, W. J.; Sease, J. D. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 8p. Dep. NTIS $4.00.

A technique was developed that allows differentiation between the closed and open pores of a solid. The technique involves impregnating the open pores with nickel carbonyl gas, decomposing the gas to deposit nickel on the surface of the open pores, and ceramographically observing the deposited nickel. The technique was shown to be applicable to pyrolytic carbon, graphite, stabilized zirconia, alumina, and porcelain. (auth)

7891 (SAND--75-8640) ABSORPTION INDUCED IN OPTICAL WAVEGUIDES BY PULSED ELECTRONS AS A FUNCTION OF TEMPERATURE, LOW DOSE RATE GAMMA AND BETA RAYS, AND 14 MeV NEUTRONS. Mattern, P. L.; Watkins, L. M.; Skoog, C. D.; Barsis, E. H. (Sandia Labs., Livermore, Calif. (USA)). Oct 1975. Contract AT(29-1)-789. 42p. (CONF-750703--14). Dep. NTIS $5.00.

From IEEE annual conference on nuclear and space radiation effects; Arcata, California, USA (14 Jul 1975).

Three separate studies of radioinduced absorption in glass and plastic waveguides were completed. First, the absorption induced by low dose-rate ^{60}Co gamma rays and ^{90}Sr beta rays was measured and compared with results obtained using higher dose rates. The comparison shows the absorption is independent of dose-rate from 500 rads/day to 10^6 rads/day to total doses of 6×10^4 rads. Second, the absorption induced in optical fibers by 14 MeV neutrons was measured. The data were compared with results from ^{60}Co gamma-ray irradiations using calculated values of the neutron ionizing dose as a basis of comparison. The results show that the absorption induced by 14 MeV neutrons at the fluences reported here is determined by the neutron ionizing dose in the spectral region from 400 nm to 1100 nm. Third, the effects of temperature on the transient absorption following pulsed electron irradiation were measured. Predictions from kinetic models for geminate recombination, tunneling, thermal untrapping, and impurity-associated scavenging were compared with the experimental data. The results appear to identify kinetic

processes that determine recombination in various irradiated waveguides. (auth)

7892 CALCULATION OF THE EXPANSION IN A GRAPHITE CRYSTAL BY C_n INTERSTITIALS. Enriquez, F. (Valladolid Univ., Spain); Quintas, M. A. G.; Santos, E. Carbon; 13: No. 3, 225-231(Jun 1975).

Calculations are presented of the change of average interlayer distance in graphite, as a function of the concentration of C_n interstitials, n = 1, 2, 4 and 6. A model of a graphite crystal is considered, in which layers are taken as continuous elastic plates. A variational procedure is used to calculate the deformation of the layers. The deformation energy is calculated with a method due to Coulson and Senent. Interaction energy is expressed in terms of the interlayer potential functions of Drickamer et al, and Santos and Villagra', the latter obtained from a Thomas–Fermi calculation. The deformation of the layers, and the self-energies of the interstitials are also calculated. The results are in fair agreement with experiment. (auth)

7893 TRANSMISSION ELECTRON MICROSCOPY OF ISOTROPIC PYROCARBON DEPOSITED ON SPHERICAL PARTICLES FOR HIGH TEMPERATURE REACTOR. Pelissier, J.; Lombard, L. (CEN, Grenoble, France). Carbon; 13: No. 3, 205-210 (Jun 1975).

Thin films of isotropic pyrocarbons deposited onto nuclear fuel kernels in a fluidized bed were studied by transmission electron micrography. The pyrocarbons were found to be made of stacked growth units exhibiting a more or less spherical shape. The existence of two distinct structural arrangements of carbon atoms could be evidenced by electron diffraction: one, identical with the structure of turbostratic graphite, and the other, poorly organized, similar to vacuum evaporated amorphous carbon. Micrographs of the material clearly showed the distribution of the two pyrocarbon varieties. It is concluded from all these observations that there is a close relationship between the microstructure of the spherical growth units and that of carbon blacks. (auth)

7894 PSEUDO DIFFUSION OF NONVOLATILE METALS IN ELECTRO GRAPHITE. Wesweiler, W.; Nageshwar, G. D. (Karlsruhe Univ., Ger.). Carbon; 13: No. 3, 175-180 (Jun 1975).

Apparent diffusion coefficients for Ti, V, Cr, Nb, Mo, and Hf as carbides and for elementary Fe, Ni, and Cu in electro graphite were determined by means of an electron-microprobe analyzer. These pseudo diffusion coefficients were found to vary with the heat treatment time. However, after one hour these remained constant and followed the Arrhenius type of relation $D = D_0 \exp(-Q/RT)$. The activation energy Q was nearly constant for the metals investigated. An attempt was made to correlate the frequency factor D_0 with the heat of formation ΔH_f^{298} of the corresponding carbides. A plot of log D_0 was ΔH_f yielded two straight lines, one for the negative H_f and the other for positive ΔH_f. This method was satisfactorily applied to predict the diffusion coefficients of Zr, Sb, and Bi. (auth)

7895 THERMAL CONDUCTIVITY OF NEUTRON-IRRADIATED REACTOR GRAPHITES. Price, R. J. (General Atomics Co., San Diego, CA). Carbon; 13: No. 3, 201-204(Jun 1975).

The thermal conductivity of neutron-irradiated reactor-grade graphites made from needle coke (H-327), Gilsocoke (H-328), and isotropic petroleum coke (H-451) was measured between 22 and 800°C. Irradiation temperatures were between 600 and 1600°C, and fast neutron fluences ranged up to 10^{22} n/cm^2 (E > 0.18 MeV). Irradiation reduces the conductivity toward a saturation level which increases with irradiation temperature. For given irradiation conditions, the reduction in conductivity is greater for the needle-coke graphites than for the isotropic graphites. The dependence of conductivity on measurement temperature is reduced by irradiation. The temperature dependence of the irradiation-induced increase in thermal resistivity is in fair agreement with that predicted from lattice dynamics theory for those vacancy loops which are small compared with phonon wave-lengths. The temperature dependence is not consistent with calculations which assume a temperature-independent phonon mean free path for irradiation-induced defects. (auth)

7896 ANNEALING OF RADIATION DAMAGE IN GRAPHITE. Platonov, P. A.; Trofimchuk, E. I.; Chugunov, O. K.; Karpukhin, V. I.; Tumanov, Y. P.; Alexeev, S. I. (Moscow State Inst. of Atomic Energy). Radiat. Eff.; 25: No. 2, 105-110 (1975).

The effect of thermal annealing (up to 2000°C) on the structure and physical properties of irradiated graphite was investigated. The irradiation was carried out in the reactor at 100 to 900°C up to a dose rate of about 15×10^{20} n/cm^2 (E_n > 0.18 MeV). Two types of the material were tested: pyrolytic and reactor graphites with different grade of structure perfection. Variations of the crystal lattice parameters, linear dimensions, elastic modulus, and electrical conductivity of graphite were investigated during the irradiation and subsequent annealing. The effect of the thermal annealing on the radiation defect behavior was also investigated using the electron microscopy method. Analysis of the results made it possible to refine the model of radiation damage in graphite materials. The following three types of radiation defects form in graphite under the given conditions: (1) small complexes of interstitial atoms (4 to 10 atoms) with an annealing activation energy of Q = 1.5 to 3 eV and annealing temperature of 200 to 600°C. Annealing of these defects results in a partial recovery of the parameter "c" and electrical conductivity (1 stage). (2) Single vacancies and small complexones of vacancies (Q = 4 to 6 eV; T_{ann} = 800 to 1500°C). Annealing of the defects of this kind results in the recovery of the parameter "a" of the graphite crystal lattice and, possibly, to a partial recovery of electrical conductivity. (3) Large loops of interstitial atoms and vacancies. Annealing of large loops occurs in the temperature range of 1200 to 2000°C (Q = 6 to 8 eV) and results in the restoration of the parameter "c" of the graphite crystal lattice and of electrical conductivity. (auth)

7897 ION BOMBARDMENT OF ALKALI HALIDES. I. Range and Damage Profiles of Protons in KCl. Thompson, P. E.; Murray, R. D. (Univ. of Delaware, Newark). Radiat. Eff.; 25: No. 2, 127-132(1975).

The depth of the layer of F-centers created by protons in the energy intervals 0.5 to 2.3 MeV and 4 to 15 MeV was measured in single crystal KCl. Photomicrographs were taken of irradiated crystals using F-band light. The optical density of the negatives was measured and calibrated to give a graph of optical density versus distance into the crystal. Using the stopping power of protons in argon, a theoretical range-energy curve was calculated. Experimental results correspond to this curve within experimental error. The damage profiles produced by protons in the high energy interval showed Bragg peaks, consistent with the rise in energy-loss rates of slowing protons. The damage profiles produced by protons in the low energy interval did not exhibit Bragg peaks, a feature attributed to the combined effect of reduced F-center production efficiency of low energy protons and saturation in the F-center concentration. (auth)

7898 DISTRIBUTION OF STRESSES AND STRAINS IN COMPONENTS OF COMPOSITE MATERIALS. Lapshina, I. F.; Mendel'son, V. M.; Volkov, S. D. (Ural Pedagogic Inst., Sverdlovsk, USSR). Strength Mater. (USSR) (Engl. Transl.); 6: No. 12, 1452-1457(Dec 1974).

Translated from Probl. Prochnosti; 6: No. 12, 31-35(Dec 1974).

The theory of limit sums, generalized to an n-component composite, is used to calculate the distributions of stresses and strains at composite points and at individual components. A numerical example is presented for W–Cu composites. (DLC)

7899 ION BOMBARDMENT OF ALKALI HALIDES. II. Effects Observed at High Fluence. Wardle, M. W.; Murray, R. B. (Delaware Univ., Newark). Radiat. Eff.; 25: No. 2, 133-139(1975).

Color-center effects unique to crystals irradiated to high fluence (10^{16} particles/cm^2) are reported for KCl and other alkali halides. These include (1) a minimum in F-center concentration at the end of the proton range and (2) an F-center distribution profile which changes with time in the dark at room temperature after irradiation. The first effect is due to annihilation of F centers by hydrogen atom capture (U-center formation) and the second is due to F-center diffusion and aggregation in a heavily damaged region of the crystal. (auth)

7900 LOW COST B–Al COMPOSITES BY CAST TAPE. Camahort, J. L. (Lockheed Missiles and Space Co., Inc. Sunnyvale, CA); Krukonis, V. J.; Wawner, F. E. SAMPE Q.; 6: No. 4, 40-43(Jul 1975).

A low cost, fully densified B/Al material form, i.e., continuous cast tape produced with nitrided boron, is described. Results show that this material exhibits excellent longitudinal properties even after secondary processing at 1100-1160°F. The transverse strength of the cast tape material was found, however, to be lower than that of conventional diffusion bonded B/Al. The tradeoff between a thick nitride coating which provides high longitudinal strength but low transverse strength, and a thinner coating with its improved transverse values but lower longitudinal values, is discussed. (auth)

7901 EFFECTS OF RADIATION-INDUCED CROSS-LINKING OF MECHANICAL PROPERTIES OF BORON–EPOXY COMPOSITES. Bullock, R. E. J. Compos. Mater.; 8: No. 1, 97-102(Jan 1974).

The paper attempts to correlate the increase in elastic modulus and strength of epoxy matrix systems due to radiation exposure with the prediction of micromechanical theories which suggest that filament-controlled strengths should increase with increase in matrix modulus. Matrix strength and modulus were determined

as a function of gamma-ray doses from four-point bending of specimens with fibers aligned perpendicular to the beam axis. Bond strengths were obtained from short-beam shear tests, and filament-controlled strengths and moduli were obtained from three-point bending of specimens with fibers aligned along the beam axis. It is shown that transverse flexural strength and modulus increase with increasing gamma dose until the apparent maximum cross-linking is obtained and then decrease thereafter. In contrast with the micromechanical theories, the longitudinal flexural strength and modulus are unchanged in the region of gamma dose in which matrix properties are enhanced but begin to increase at higher doses where matrix properties are significantly degraded. Thus, any functional relationship between matrix-controlled and filament-controlled properties is found in the matrix-degradation region at high exposure doses and is an inverse relationship. (Appl. Mech. Rev.)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

7902 (BNWL-SA-5559) SYSTEM DESIGN AND EVALUATION FOR NATION SAFEGUARDS SYSTEMS. Bennett, C. A.; Murphey, W. N.; Sherr, T. S. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. 27p. (CONF-751017-14). Dep. NTIS $5.00.

From symposium on safeguards of nuclear materials; Vienna, Austria (20 Oct 1975).

The discussion of the societal risk approach covers: definition of risk; the safeguards problem; the safeguards system; evaluation of risk; and utilization of the societal risk model. (LK)

7903 (LA-6040-PR) NUCLEAR ANALYSIS RESEARCH AND DEVELOPMENT. Program Status Report, January--April 1975. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1975. Contract W-7405-ENG-36. 17p. Dep. NTIS $4.00.

Progress is reported in the following areas of research: neutron interrogation (active) assay applications; passive assay applications; and, instrument development and measurement controls. The ERDA-sponsored nondestructive assay training program is discussed. (JGB)

7904 (LA-6045-SR) ANALYTICAL METHODS FOR FISSIONABLE MATERIALS IN THE NUCLEAR FUEL CYCLE. Covering June 1974--June 1975. Waterbury, G. R. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-Eng-36. 14p. Dep. NTIS $4.00.

Research progress is reported on method development for the dissolution of difficult-to-dissolve materials, the automated analysis of plutonium and uranium, the preparation of plutonium materials for the Safeguard Analytical Laboratory Evaluation (SALE) Program, and the analysis of HTGR fuel and SALE uranium materials. The previously developed Teflon-container, metal-shell apparatus was applied to the dissolution of various nuclear materials. Gas–solid reactions, mainly using chlorine at elevated temperatures, are promising for separating uranium from refractory compounds. An automated spectrophotometer designed for determining plutonium and uranium was tested successfully. Procedures were developed for this instrument to analyze uranium–plutonium mixtures and the effects of diverse ions upon the analysis of plutonium and uranium were further established. A versatile apparatus was assembled to develop electrotitrimetric methods that will serve as the basis for precise automated determinations of plutonium. Plutonium materials prepared for the Safeguard Analytical Laboratory Evaluation (SALE) Program were plutonium oxide, uranium–plutonium mixed oxide, and plutonium metal. Improvements were made in the methods used for determining uranium in HTGR fuel materials and SALE uranium materials. Plutonium metal samples were prepared, characterized, and distributed, and half-life measurements were in progress as part of an inter-ERDA-laboratory program to measure accurately the half-lives of long-lived plutonium isotopes. (auth)

Disposal and Storage

Refer also to abstracts 7000, 7003, and 7015.

7905 (AECL-5249) WASTE MANAGEMENT IN CANADIAN NUCLEAR PROGRAMS. Dyne, P. J. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Aug 1975. 22p. (CONF-750699-3). Dep. NTIS (US Sales Only) $4.50. AECL $0.50.

From 15th annual international conference; Ottawa, Canada (15 Jun 1975).

The operation of a nuclear reactor produces radioactive materials, some of which do not appear to have any value and are wastes. This report describes the wide-ranging program of engineering developments and applications to provide the Canadian nuclear industry with the knowledge and expertise to conduct its waste management functions safely and responsibly. (auth)

7906 (ARH-SA-232) CHARACTERIZATION OF ACTINIDE-BEARING SEDIMENTS UNDERLYING LIQUID WASTE DISPOSAL FACILITIES AT HANFORD. Price, S. M.; Ames, L. L. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Sep 1975. Contract E(45-1)-2130. 23p. (CONF-751105-18; SM-199/87). Dep. NTIS $4.50.

From IAEA international symposium on transuranium nuclides in the environment; San Francisco, California, USA (17 Nov 1975).

Past liquid waste disposal practices at the U. S. Energy Research and Development Administration's Hanford Reservation have included the discharges of solutions containing trace quantities of actinides directly into the ground via structures collectively termed "trenches". Characterization of samples from two of these trenches, the 216-Z-9 and the 216-Z-1A(a), has been initiated to determine the present form and migration potential of plutonium stored in sediments which received high salt, acidic waste liquids. Analysis of samples acquired by drilling has revealed that the greatest measured concentration of Pu, approximately 10^6 mu Ci ^{239}Pu/liter of sediment, occurs in both facilities just below the points of release of the waste liquids. This concentration decreases to approximately 10^3 mu Ci ^{239}Pu/liter of sediment within the first 2 meters of the underlying sediment columns and to approximately 10 mu Ci ^{239}Pu/liter of sediment at the maximum depth sampled (9 meters). Examination of relatively undisturbed sediment cores illustrated two types of Pu occurrence responsible for this distribution. One of these types is composed of Pu particles (greater than 70 wt percent PuO_2) added to the disposal site in the same form. This "particulate" type was "filtered out" within the upper 1 meter of the sediment column, accounting for the high concentration of Pu/liter of sediment in this region. The second type of Pu (less than 0.5 wt percent PuO_2) was originally disposed of as soluble Pu(IV). This "nonparticulate" type penetrated deeper within the sediment profile and was deposited in association with silicate hydrolysis of the sediment fragments. (auth)

7907 (COO-2689-1) RESULTS OF R/V YAQUINA CRUISE YALOC-74, LEG 3: SEABED DISPOSAL PROGRAM, NORTH PACIFIC STUDY AREA MPG-2, 33°20'N, 151°00'W, NOVEMBER 30--DECEMBER 21, 1974. Heath, G. R. (Rhode Island Univ., Kingston (USA). Graduate School of Oceanography). Jul 1975. Contract E(11-1)-2689. 31p. Dep. NTIS $5.00.

During 10 days in the vicinity of 33°20'N, 151°00'W (MPG-2 area), three near-bottom current meters were deployed, the bathymetry and subbottom acoustic structure of the surrounding seafloor were determined, and sediment cores were collected for studies of artificial radionuclide distribution, geotechnical properties, geochemical properties, and to identify the character of shallow acoustic reflectors. Large volume water samples for artificial radionuclide studies and suspended sediment were also collected. These samples and data will supplement earlier material to be used in the evaluation of the central North Pacific as a potential site for the ultimate disposal of high-level reactor wastes. (auth)

7908 MANAGEMENT OF RADIOACTIVE WASTES RESULTING FROM EMERGENCY SITUATIONS ON LAND AND SEA. Morrison, J. A. (Atomic Energy of Canada Ltd., Chalk River, Ont.). At. Energy Rev.; 13: No. 2, 413-421 (Jun 1975).

The term "emergency" applies to unplanned events that have generated, or had the potential to generate, radioactive wastes that could not be handled locally. Reports of past emergencies form the basis for discussion of future trends in emergency situations, the factors that influence waste management, the technology of waste management and personnel requirements. The number of past emergencies has been small and these have not increased the volume of radioactive wastes significantly. The majority of future emergencies are likely to be associated with reactors as they have been in the past. Little change in the nature of the waste is expected, although the greater use of separated plutonium may create some new problems. The factors that influence emergency waste management fall into two categories, those that are concerned with the location of the emergency event, and those concerned with the characteristics of the wastes. As in the past, it can be expected that in most emergencies proven waste management techniques will be adapted to suit the local circumstances but there is a need for simpler and more economic methods. Trained personnel and comprehensive planning are cited as key factors in successful waste management operations. (auth)

7909 INCINERATION OF ANIMAL RADIOACTIVE WASTE. A Comparative Cost Analysis. Gregory, W. D.; Maillie, H. D. (Rochester Univ., NY). Health Phys.; 29: No. 3, 389-392 (Sep 1975).

Incineration of radioactive waste has been found to be an excellent method for reducing both the bulk and the handling problems associated with the use of animals in a research institution. A cost analysis has been made at the University of Rochester for the incineration of certain wastes as compared to the cost of land burial. In determining the feasibility of incineration for a radioisotope the major factors to be considered are the activity, half-life, and maximum permissible air concentration of the isotope and the size of the carcass in which it is incorporated. Com-

parative examples are given for several specific isotopes in use at this institution. Environmental factors are also considered. (auth)

Handling Equipment and Procedures

7910 (CONF-751101-23) COMMENTS ON THE USE OF THE MONTE CARLO METHOD FOR CRITICALITY CALCULATIONS. Whitesides, G. E. (Union Carbide Corp., Oak Ridge, Tenn. (USA). Nuclear Div.). 1975. 5p. Dep. NTIS $4.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

As evidenced by recent papers given at Nuclear Criticality Safety Division meetings, the use of the Monte Carlo method has become a very popular computational tool. The ease of use has undoubtably been a primary reason for this popularity. This ease of use, however, may lead to a false sense of security when using the method. Guidance on the effective use of the method and some suggestions on how to avoid some of the pitfalls that can occur are presented. (TFD)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstract 8440.

7911 (BNL-20480) PRELIMINARY DESIGN AND COST ESTIMATE FOR A 600 MeV, 20 MICROAMPERE PROTON SYNCHROTRON. Blewett, J. P.; Chasman, R.; Cottingham, J. G.; Grand, P.; Green, G. K.; Lasky, C. (Brookhaven National Lab., Upton, N. Y. (USA)). 3 Sep 1975. 24p. Dep. NTIS $4.50.

A design study is presented for a 600 MeV proton synchrotron to yield an average current of 20 microamperes. Its purpose is production of negative pions for use in cancer therapy. The machine consists of a 4 MeV electrostatic preinjector, a 20 MeV linac injector, and a magnet ring about 20 meters in diameter. (auth)

7912 (CERN-75-13) AGS: THE ISR COMPUTER PROGRAM FOR SYNCHROTRON DESIGN, ORBIT ANALYSIS, AND INSERTION MATCHING. Keil, E.; Marti, Y.; Montague, B. W.; Sudboe, A. (European Organization for Nuclear Research, Geneva (Switzerland)). 24 Oct 1975. 62p. Dep. NTIS (US Sales Only) $5.50.

A detailed guide is given for the use of the current version of a FORTRAN program for carrying out computations required in the design or modification of alternating gradient synchrotrons and storage rings. The program, which runs on the CDC 7600 computer at CERN, computes linear transformation matrices of a ring structure, its betatron and dispersion functions, and modifications of parameters to achieve specified properties; it tracks sets of particle trajectories, finds closed orbits when elements of the structure are displaced, computes the equilibrium orbit, designs closed-orbit bumps, tracks betatron functions through the structure, and matches insertions in the structure to specified betatron and dispersion functions. (auth)

7913 (CERN-75-14) MONTE CARLO CALCULATIONS OF THE NEUTRON TRANSMISSION THROUGH THE ACCESS WAYS OF THE CERN SUPER PROTON SYNCHROTRON. Vogt, H. G. (European Organization for Nuclear Research, Geneva (Switzerland)). 6 Nov 1975. 42p. Dep. NTIS (US Sales Only) $5.00.

Calculations of the neutron attenuation, of interest for radiation protection purposes, are described for the various access ways (tunnels and shafts for passage of heavy material and personnel as well as cable ducts) of the CERN SPS. The configurations of the duct systems are summarized, and the characteristics of the neutron sources (line and point geometry) are presented. Source energies from thermal to 15 MeV are taken into account. Different material compositions (concrete with 0 to 10% water content), the influence of air-scattering, and the effect of traps on the neutron transmission are considered. The Monte Carlo code SAM-CE, for the solution of the energy dependent and time dependent neutron and gamma ray transport equations in complex three dimensional geometries, and its application are briefly discussed. The results of calculations using this code are presented as graphs showing attenuation curves (dose rates versus distance) for various access ways, energy spectra of neutrons backscattered from concrete slabs having various reflector thickness, and spectral distributions at different depths in the access ways considered. (auth)

7914 (DEU-75-8) ANNUAL REPORT 1972. Ebert, W.; Kernbach, K. G. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Physikalisches Inst.). 1972. 325p. (In German). INIS.

With figs., tabs. and refs.

Most of the scientific tasks of the institute were carried out with the Tandem accelerator. The investigations with polarized particles in the field of nuclear physics were particularly successful in explaining the reaction mechanisms in the presence of resonances. In heavy-ion physics, the study of intermediary structures below the Coulomb wall gave clear indications on α-particle states. Meson effects with g factors of excited nuclear states were even found in local investigations. The Lamb shift source, developed in the institute, was set up for installation on the Tandem, with the help of experience gained on the test model. Because the energy and radiation time of the Erlangen accelerator is not sufficient for many experiments, experiments were carried out on accelerators in Karlsruhe and Hamburg, and laboratory experiments on the Moessbauer effect and with atomic beams were intensified. (auth)

7915 CEA/IN2P3, THE HEAVY ION ACCELERATOR GANIL. CERN Cour.; 11: No. 15, 355-358(Nov 1975).

A description is given of the main characteristics of the heavy ion accelerator GANIL to be constructed as a joint project of the French Commissariat à l'Energie Atomique (CEA) and the Institut de Physique Nucléaire et de Physique des Particules (IN2P3). The facility will consist of two sector-focused cyclotrons, their beam injectors, and eight experimental areas. The accelerator is to be partially operative by 1980. (PMA)

7916 PROBLEMS OF RADIATION CLEANNESS AND EFFICIENCY IN MODERN LINACS WITH LARGE AVERAGE CURRENTS OF PROTONS AND NEGATIVE HYDROGEN IONS. Murin, B. P.; Fedotov, A. P. At. Energ. (USSR); 38: No. 3, 146-151(Mar 1975). (In Russian).

Consideration was given to specific features of linacs with proton and negative hydrogen ion energies of several hundred MeV and total average currents of tens and hundreds of milliamperes, for which the problem of radiation cleanness and high efficiency are important. The transverse and longitudinal emittances must be filtered to keep beam loss below 10^{-4}–10^{-6} (radiation-clean accelerator) in the main part of the accelerator. Various filter designs are discussed. Particular attention is paid to H^- losses due to their charge exchange with the residual gas. The design of a linac providing continuous beams of protons and H^- ions at an overall efficiency of about 60% for currents of 150-200 mA is feasible with present-day technology. (auth)

Auxiliaries and Components

7917 (BNL-20605) CONDUCTOR FABRICATION FOR ISABELLE DIPOLE MAGNETS. McInturff, A. D. (Brookhaven National Lab., Upton, N.Y. (USA)). 1975. 4p. (CONF-750950-3). Dep. NTIS $4.50.

From conference on technical applications of superconductivity; Alushta, USSR (16 Sep 1975).

Fabrication techniques and specifications are discussed for the composite superconductor braids to be used in the dipole magnets of the ISABELLE Storage Rings. Properties of the NbTi and Cu composite superconductor are given, the braid parameters are presented, and the fabrication processes are shown in photographs. (PMA)

7918 FAST CALORIMETER FOR ENERGETIC BEAM MEASUREMENTS. Hammond, D. P. (United Kingdom Atomic Energy Authority Research Group, Abingdon, Eng.). J. Phys., E (London); 8: No. 10, 810-811(Oct 1975).

A method of measuring power density at a point in an energetic particle beam is described. The temperature rise of a short length of wire which is conduction cooled at each end and directly irradiated by the beam is measured. By combining the electrical outputs of a number of detectors, the sensitivity and time constant of such a system are discussed and some experimental results are given. (auth)

7919 OPERATIONAL 40 kG SUPERCONDUCTING BEAM TRANSPORT MAGNET AND ITS CRYOGENIC SYSTEM. Allinger, J.; Bamberger, J.; Danby, G.; DeVito, B.; DiLullo, C.; Foelsche, H.; Gibbs, R.; Hsieh, S.; Jackson, J.; Prodell, A. (Brookhaven National Lab., Upton, NY). J. Eng. Ind.; 97: No. 3, 921-924(Aug 1975).

From American Society of Mechanical Engineers winter annual meeting; New York, NY, USA (17 Sep 1974).

A superconducting 40 kG magnet system 4 meters long is now operating which bends the 30 billion electron volt primary proton beam produced by the Brookhaven Alternating Gradient Synchrotron. The magnet design is unique in that commercially available niobium titanium composite superconductor and relatively high purity aluminum are used in combination with low carbon steel magnet cores to provide excellent magnetic and thermal stabilization. This magnet system is operating on line in a closed loop, zero loss helium refrigeration system. Details of the magnet structure, dewars, and cryogenic system will be discussed. (auth)

Ion Sources and Injection and Extraction Systems

7920 (CONF-751048-3) LIFETIMES OF CARBON STRIPPING FOILS. Yntema, J. L. (Argonne National Lab., Ill. (USA)). Oct 1975. Contract W-31-109-Eng-38. 5p. Dep. NTIS $4.50.

From international conference on heavy ion sources; Gatlinburg, Tennessee, USA (27 Oct 1975).

In an effort to produce a coherent picture of foil lifetimes, a review is given of results of various authors on the use of carbon

foil beam strippers for heavy ion facilities. Foil heating in the tandem terminal during heavy ion bombardment, combined with oscillation of the foil, should produce acceptable foil lifetimes and improve the beam quality by reduction of the foil thickening effect and the accompanying inhomogeneity. The installation and operation of such a system does not present insurmountable problems. (PMA)

7921 (GSI-PB-2-75) UNILAC: PROJECT REPORT NO. 16. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Jul 1975. 24p. (In German). INIS.

With figs., tabs. and refs.

A report is given on a duoplasmatron ion source for multiply charged xenon ions, on the production of metal ions in a penning source, on the helical structure in the stripper region of the UNILAC and on a beam-foil apparatus for the investigation of transition probabilities in this project report. (GE)

7922 SOLVOLYSIS OF COVALENT ARYLSULFONYLMETHYL PERCHLORATES. General Base Catalysis by Dipolar Aprotic Solvents. Menninga, L.; Steenge, W. D. F.; Engberts, J. B. F. N. (Univ., Groningen, Netherlands). J. Org. Chem.; 40: No. 22, 3292-3295(31 Oct 1975).

The dynamic basicity of Me_2SO and Me_2SO–H_2O mixtures was studied employing the rates of irreversible deprotonation of two carbon acids as a kinetic probe. Upon the gradual addition of Me_2SO to water, a continuous and strong rate of reaction was observed until at mole fraction of water, n/sub H_2O/ equals 0.62, the rate became too fast to be measured with the available kinetic equipment. The small change of the magnitude of the primary kinetic deuterium isotope effect (k/sub H//k/sub D/) as a function of n/sub H_2O/ indicates that in the Me_2SO-rich mixtures the mechanism of hydrolysis does not change from a base-catalyzed process to nucleophilic substitution. (JGB)

Ion Optics and Field Calculations

7923 (BNL-20325) FIELDS AND FORCES FOR RECTANGULAR BEAMS IN AN AGS. Herrera, J. C. (Brookhaven National Lab., Upton, N.Y. (USA)). 26 Jun 1975. 19p. Dep. NTIS $4.50.

The direct space-charge fields and forces that are present in a proton beam which has a rectangular cross section and a uniform charge density are considered. The horizontal and vertical betatron tune shifts, corresponding to these forces, which occur within such a beam are calculated. In addition, a direct extension of this rectangular model produces analytical expressions for the tune changes characteristic of a beam profile which has symmetrical or unsymmetrical linear variations of charge density at the horizontal edges of the beam. (auth)

7924 (HMI-B-167) NUMERICAL SOLUTION OF ELECTROSTATIC PROBLEMS OF THE ACCELERATOR PROJECT VICKSI. Janetzki, U. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany). Bereich Kern- und Strahlenphysik). Mar 1975. 37p. (In German). INIS.

25 figs.; 10 refs.

Numerical solutions are presented for a few electrostatic problems which have resulted from the heavy ion accelerator project VICKSI. The versatility of the numerical method is to be demonstrated in selected examples, and use of the method for similar problems is discussed. The numerical process for solving ion-optics problems consists of two steps. In the first step, the potential distribution for a given boundary value problem is iteratively calculated for the Laplace equation. The image characteristics of the electostatic lens are investigated using ray tracing in the second step. (auth)

7925 (JINR-P11-9107) INVESTIGATION OF THE SOLUTION OF SYSTEMS OF NONLINEAR DIFFERENTIAL EQUATIONS WITH PERIODIC COEFFICIENTS IN THE VICINITY OF THE RESONANCE 2 nu/sub z/--nu/sub x/ equals 1 BY THE AVERAGING METHOD. Amirkhanov, I. V.; Vasilev, V. K.; Zhdkov, E. P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 12p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

Systems of non-linear differential equations with periodic coefficients in the vicinity of the resonance 2 nu/sub z/-nu/sub x/ equals 1 were investigated. Shortened equations were found by the averaging method. These equations were investigated. (tr-auth)

7926 (JINR-P9-9120) INCREASING INTENSITY OF THE BEAM ACCELERATED IN JINR SYNCHROPHASOTRON. II. Resonance Losses, Comparison of Experiment and Theory. Further Perspectives. Beznogikh, Yu. D.; Bonch-Osmolovskii, A. G.; Voevodin, M. A.; Zinov'ev, L. P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Resonances due to the dynamic Coulomb displacement of the oscillation frequency and responsible for particle loss in the synchrophasotron were determined. The widths and strengths of these resonances were evaluated, and a comparison was made between theory and experiments. Future development trends to increase the beam intensity of the accelerator are indicated. (tr-auth)

7927 MECHANICAL ANALOG OF THE SYNCHROTRON, ILLUSTRATING PHASE STABILITY AND TWO-DIMENSIONAL FOCUSING. Alvarez, L. W. (Univ. of California, Berkeley); Smits, R.; Senecal, G. Am. J. Phys.; 43: No. 1, 293-296(Jan 1975).

A steel ball bounces in synchronism with a vertically oscillating piston. The piston surface is a hardened steel disk on which the ball bounces; two-dimensional horizontal focusing is provided by the concavity of the surface. The period of oscillation can be varied over a 3:1 range with the amplitude kept constant. As the period is increased, the ball bounces higher. As the period is decreased, the ball bounces lower, contrary to the intuition of most observers. The model illustrates the important properties of synchrotron accelerators. (3 figures) (auth)

Storage Rings

Refer also to abstract 7912.

7928 (BNL-20565) ISABELLE FULL SCALE DIPOLES. McInturff, A. D.; Dahl, P. F.; Kassner, D.; Lasky, C.; Robins, K.; Sampson, W. B. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 5p. (CONF-750950-4). Dep. NTIS $4.50.

From conference on technical applications of superconductivity; Alushta, USSR (16 Sep 1975).

Data are presented on the various cosine theta type magnet models constructed at BNL in the development of ring magnets for ISABELLE, a pair of intersecting 200 GeV proton accelerating storage rings. The rings are to be filled with 30 GeV protons from the AGS and then accelerated to 200 GeV. The acceleration period is a 120 sec ramp from approximately 0.5 T to 4 T. The effect of mechanical precompression on training was studied by varying the interference fit between the coil (ISA IV) and its iron shield. The results were used to optimize the mechanical design of the full-size magnet models. (auth)

7929 (BNL-20584) REEXAMINATION OF THE ISABELLE BOX CAR STACKING SCHEME. Chasman, R. (Brookhaven National Lab., Upton, N. Y. (USA)). 26 Aug 1975. 12p. Dep. NTIS $4.50.

Box car stacking of ISABELLE after acceleration of the fundamental frequency in the AGS is reviewed with the present ISABELLE parameters and examined with regard to longitudinal impedance requirements. The scheme results in an impedance tolerance of Z/n less than or equal to 30 OMEGA compared to Z/n less than or equal to 5 OMEGA obtained for rf stacking. However, to meet the claimed luminosity, the AGS performance demands are increased above those assumed in the ISABELLE proposal. (auth)

7930 (BNL-20609) RING INSERTIONS AS LIGHT SOURCES. Green, G. K. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 12p. (CONF-751067-1). Dep. NTIS $4.50.

From Madison users meeting; Stoughton, Wisconsin, USA (20 Oct 1975).

Bending magnets can be inserted in the long straight sections of electron storage rings to produce synchrotron radiation. If the design is carefully proportioned, the bending magnets create only a small perturbation of the properties of the ring. The resulting spectra have favorable optical properties as sources for spectroscopy and diffraction studies. The characteristics of the source are discussed, and the geometrical requirements of the magnets are presented. (PMA)

Experimental Facilities

Refer also to abstracts 7377, 7388, and 7914.

7931 (CONF-751116-4) AUXILIARY/MASTER MICROPROCESSOR CAMAC CRATE CONTROLLER APPLICATIONS. Barsotti, E. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). 1975. 4p. Dep. NTIS $4.50.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

The need for further sophistication of an already complex serial CAMAC control system at Fermilab led to the development of an Auxiliary/Master CAMAC Crate Controller. The controller contains a Motorola 6800 microprocessor, 2K bytes of RAM, and 8K bytes of PROM memory. Bussed dataway lines are time shared with CAMAC signals to provide memory expansion and direct addressing of peripheral devices without the need of external cabling. The Auxiliary/Master Crate Controller (A/MCC) can function as either a Master, i.e., stand alone, crate controller

or as an Auxiliary controller to Fermilab's Serial Crate Controller (SCC). Two modules, one single- and one double-width, make up an A/MCC. The microprocessor has one nonmaskable and one maskable vectored interrupt. Time sharing the dataway between SCC programmed and block transfer generated dataway cycles and A/MCC operations still allows a 99 percent microprocessor CPU busy time. Since the conception of the A/MCC, there has been an increasing number of control system-related projects proposed which would not have been possible or would have been very difficult to implement without such a device. The first such application now in use at Fermilab is a stand-alone control system for a mass spectrometer experiment in the Main Ring Internal Target Area. This application in addition to other proposed A/MCC applications, both stand-alone and auxiliary, is discussed. (auth)

7932 SOVIET MEDICAL LINEAR ACCELERATOR WITH EXTRACTED ELECTRON BEAM OF 25 MeV. Aleksandrov, N. N.; Zhakov, I. G.; Gumanskii, G. A. pp 196-198 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The beam characteristics of the 25-MeV electron linear accelerator, with which megavolt bremsstrahlung beams can also be obtained, are briefly described. Studies made on the RBE of the beam are summarized. (JSR)

7933 POSSIBILITIES OF MAKING STUDIES ON RADIOTHERAPY AND OTHER MEDICAL-BIOLOGICAL PROBLEMS AT THE SYNCHROCYCLOTRON LABORATORY OF NUCLEAR PROBLEMS OF JINR. Boreiko, V. F.; Bugarchev, B. B.; Vainberg, M. Sh.; Valuev, Yu. M.; Dzhelepov, V. P.; Kalinin, A. I.; Komarov, V. I.; Krasnoborodov, B. S.; Savchenko, O. V.; Stekol'nikov, V. P.; Sharapov, B. N. pp 199-206 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The facilities for radiotherapeutic and medical-biological studies available at the JINR proton beam are described in detail. The dosimetric methods developed for use with this beam are also described. The beam intensity can be varied from 90 to 185 MeV. (JSR)

7934 EXTERNAL PROTON BEAM OF THE ITEF (INSTITUTE OF THEORETICAL AND EXPERIMENTAL PHYSICS) ACCELERATOR AND FACILITIES FOR ITS MEDICAL-BIOLOGICAL USE. Khoroshkov, V. S.; Barabash, A. Z.; Blokhin, S. I.; Bladin, L. L.; Lomanov, I. F.; Onosovskii, K. K. pp 206-210 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The ITEP accelerator can provide an external proton beam with energies up to 200 MeV. The beam extraction system and the facilities for controlling, monitoring, and measuring the beam in the irradiation room are described in detail. (JSR)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

7935 USKORENIE CHASTITS I YADERNYE REAKTSII V KOSMOSE. (Particle Acceleration and Nuclear Reactions in Space. 6th International Seminar, Leningrad, USSR, August 19–21, 1974). Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). 404p. (In Russian and English). (CONF-740851–).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974).

In introductory remarks to the Seminar a brief summary is given of the program planning. The topics to be discussed at the Seminar are solar physics and astrophysics, variation of cosmic radiation and solar wind, acceleration of particles, isotopic abundance and galactic cosmic rays, and x-ray and gamma astronomy. Of the 40 contributions made, only abstracts were published for 18. Separate abstracts were prepared for the remaining 22 contributions. (JSR)

For abstracts of individual papers see: 7941–7950, 8035–8041, 8070, 8071, 8095–8109, 8179, 8246, 8247, 8252, 8253, 8258, 8570, and 8642.

Cosmic Radiation

Refer also to abstracts 7935, 8034, 8040, 8071, 8094, 8095, 8104, 8105, 8113, 8119, 8178, 8183, and 8573.

7936 (N-75-14698) CALCULATIONS OF THE MOON'S HEAT HISTORY AT DIFFERENT CONCENTRATIONS OF RADIOACTIVE ELEMENTS TAKING ACCOUNT OF THE MATERIAL DIFFERENTIATION WITH MELTING. Arnatskaya, O. I.; Alber, Ya. I.; Ryazantseva, I. L. (National Aeronautics and Space Administration, Houston, Tex. (USA). Lyndon B. Johnson Space Center). 1974. 32p. (NASA-TM-X-72201). NTIS $3.75.

From Soviet-American conference on the cosmochemistry of the moon and planets; Moscow, USSR (4 Jun 1974).

A mathematical procedure for analyzing the heat conductivity of the lunar surface is discussed. The solution is based on homogeneous and laminated moon models and considers the effects of radioactive elements conveyed to the lunar surface by melting. The various parameters which introduce uncertainties into the numerical analysis are identified. The application of data obtained from radio astronomy and from analyses of lunar samples returned by the Apollo flights is explained. Tables of data are included to show the types and amounts of radioactive materials which have been identified. (STAR)

7937 (N-75-21195) RESULTS OF A STUDY OF THE MALAKAL CHONDRITE (SUDAN). El-Rabaa, S. M.; Daminova, A. M.; D'yakonova, M. I.; Kvasha, L. G.; Levskii, L. K.; Fisenko, A. V. Translated from Meteoritika; No. 33, 83-89(1974). 16p. (NASA-TT-F-16074). NTIS $3.25.

The structure is discussed of the Malakal meteorite, which fell in the Sudan at the beginning of August 1970. The primary minerals proved to be olivine, orthopyroxene, nickel iron, and troilite. Chemical analysis was performed separately on the magnetic and nonmagnetic portions of the meteorite, and according to the resulting data, this meteorite belongs to the L group of chondrites. Mineralogically, it is shown to belong to the hypersthene olivine chondrites. The radiogenic ages of the meteorite were computed. (auth)

7938 PROBLEMY SOVREMENNOI FIZIKI. (Problems of Modern Physics). Tuchkevich, V. M. (ed.). Leningrad; Izdatel'stvo Nauka (1974). 365p.

Some selected problems in various branches of physics, including physico-chemical analysis, thermodynamics, plasma physics, astrophysics, cosmic radiation, and holography, are investigated. Some of the topics covered include the connection between polynucleide chains and oligomers studied with the aid of chromatography, microwave plasma heating, study of neutrons and gamma-rays in the atmosphere, satellite studies of multiply charged components of cosmic rays, and the simulation of cometary phenomena. (auth)

7939 HIGH LET PARTICLE RADIATION INSIDE SKYLAB (SL2) COMMAND MODULE. Peterson, D. D.; Benton, E. V. (Univ. of California, San Francisco). Health Phys.; 29: No. 1, 125-130(Jul 1975).

The fluence, flux, and integral LET spectrum of high LET particles inside the Skylab (SL2) Command Module are presented. The results are derived from the analysis of plastic nuclear track detectors located at five different positions inside the command module. For particles with $L_\infty \gtrsim 105$ keV/μm·tissue, the average planar fluence and flux are 53.2 particles/cm^2·2π ster and 1.90 particles/cm^2·day·2π ster, respectively. The integral LET spectrum decreases steeply toward high LET values. Compared with similar results from the Apollo 17 lunar mission, the high LET particle flux is lower and the integral LET spectrum is steeper in the Skylab mission. (auth)

7940 ABSOLUTE COSMIC RAY FLUX AT SEA LEVEL. Allkofer, O. C.; Carstensen, K.; Dau, W. D.; Jokisch, H. (Univ., Kiel). J. Phys., G (London); 1: No. 6, L51-L52(1 Aug 1975).

The absolute integral fluxes of cosmic ray muons above 0.35 GeV/c at sea level are presented. The values are by 13% higher than the standard values quoted by Rossi (Rev. Mod. Phys.; 20: 537 (1948)). (auth)

7941 BURSTS OF NEUTRINO AND ANTINEUTRINO RADIATION. Kocharov, G. E. pp 125-130 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851–.

The analysis of the experimental results on the bursts of cosmic antineutrinos and solar neutrinos has been done. A genetic connection between the bursts of X and γ rays and neutrinos is supposed. The necessity of simultaneous measurements of neutrinos, antineutrinos, X and γ rays is argued. (auth)

7942 2-YEAR CYCLE OF GALACTIC COSMIC RAYS IN INTERPLANETARY SPACE AND TOTAL MAGNETIC FIELD OF THE SUN. Vernov, S. N.; Charakhch'yan, A. N.; Stozhkov, Yu. I.; Charakhch'yan, T. N. pp 153-158 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851–.

The experimental data of the primary cosmic ray intensity, N(t), in the interplanetary space are presented from 1958 to the present. The empirical relationship N with the eleven solar activity cycle is discussed, $N = N_0 \exp(-A\eta^{0.8}\varphi^{-1.2})$, where η—the number group of sunspots, φ—their average heliographic latitude. The fundamental parameters characterizing the galactic cosmic rays diffusive propagation in the interplanetary space are presented. The correlation of N with solar activity was broken in 1971-1972. It is explained as a new phenomenon of cosmic ray modulation due to the change of total solar magnetic field in this observation period. (auth)

7943 PROBLEM OF SUBCOSMIC RAYS: MODULATION, SPECTRUM, COMPOSITION, NUCLEAR INTERACTIONS, ACCELERATION, ROLE IN SPACE. Dorman, L. I. pp 171-174 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851–.

The quiet period cosmic ray spectrum is divided into 4 intervals: I – $E_k \lesssim 1$ MeV/nucleon, II – $1 \lesssim E_k \lesssim 30$ MeV/nucleon, III-30 MeV/nucleon $\lesssim E_k \lesssim 10^2$ GeV/nucleon, IV – $E_k \gtrsim 10^2$ GeV/nucleon. In interval IV cosmic rays are of galactic origin (only in the region of superhigh energy possibly they are of extragalactic origin); they are slightly subjected to solar modulation. Interval III is governed by galactic cosmic rays only; the modulation at the energy $E_k \gtrsim 3$ GeV/nucleon is proportional to E_k^{-1}; basing on the electron spectrum data at small energies more complex dependence of modulation (and hence, of scattering transport path on energy) occurs; radial and transversal gradients are discussed, and the anisotropy in this energy range. Data on the chemical composition in intervals II and III are presented. Possible nature of particles in interval II is discussed; solar particles, interplanetary acceleration, galactic cosmic rays. Conclusion: the main part of particles in interval II is of galactic origin. Chemical composition in interval I is discussed: quasi-capture of solar cosmic rays, penetration of galactic cosmic rays along the magnetic field lines of strength, penetration of neutral atoms from interstellar medium, their ionization by solar UV and acceleration in the transit layer between solar wind and galactic magnetic fields. It can't be excluded that for same nuclei the latter may be the main reason. (auth)

7944 ACCELERATION OF PROTONS AT THE BOUNDARY OF THE SOLAR WIND WITH THE INTERSTELLAR MEDIUM. Bakhareva, M. F. pp 175-176 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

Alfven magnetic pumping is proposed as a possible mechanism for the acceleration of protons in the energy range from 1 to 10 MeV. (JSR)

7945 NUCLEAR REACTIONS IN EXTRATERRESTRIAL OBJECTS AS A TOOL FOR STUDYING THE VARIATIONS OF COSMIC RADIATION. Povinec, P. pp 255-286 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The interferences on long and short term averaged fluxes of galactic and solar cosmic rays based on observed concentrations of radionuclides in extraterrestrial objects are summarized. Using suitable radionuclides it is possible to derive information on the time and space variations of cosmic rays in the past. The experimental results show that cosmogenic radionuclides enable the study of short term as well as long term variations of galactic and solar cosmic rays. (auth)

7946 EVIDENCE FOR THE R-PROCESS OF NUCLEOSYNTHESIS FROM ULTRA-HEAVY COSMIC RAYS. Kuchowicz, B. (Univ., Warsaw); Schramm, D. N. pp 287-296 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The r-process (rapid neutron capture) is assumed to occur in supernova explosions. Recent study on the evolution of massive stars appears to confirm the old suggestion that galactic supernova have enough energy to fill the galaxy with cosmic rays. On the other hand, the characteristic overabundances in the Pt peak and in the actinides region (when compared with the solar system abundances) point to an overwhelming contribution from the r-process to the ultra-heavy cosmic rays. Ratios of actinide abundances provide detailed chronometric information. (auth)

7947 ANISOTROPY OF 10^{11} TO 10^{14} eV CHARGED PARTICLES IN THE GALAXY. Somogyi, A. J. pp 311-324 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

Experimental and theoretical results concerning the anisotropy of 10^{11}-10^{14} eV particles in the galaxy are reviewed. A new, hitherto unpublished preliminary result indicates a significant anisotropy of 0.13 per cent at particle energies of $6 \cdot 10^{13}$ eV. Arguments are brought forward to justify the identification of observed anisotropy with the concept of "macro" anisotropy put forward in the theory of compound diffusion. Furthermore, it is shown that $-\alpha$, the exponent of the power spectrum of magnetic irregularities in the galaxy can be determined on the basis of the energy dependence of the anisotropy. If the latter is of a power function type with the exponent η, one obtains $\alpha = 2-4\eta$ or $\alpha = 2 - \eta$ according to the case, whether the total path-length of the particles or the scale size of the confinement volume is assumed to be independent of particle energy. (auth)

7948 CHEMICAL COMPOSITION OF COSMIC RAYS IN THE GALAXY. Ptuskin, V. S. pp 339-340 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

Transformation of cosmic ray nuclei in interstellar medium is investigated in the diffusion approximation. The propagation of the radioactive nuclei is considered. Restrictions on possible energy dependence of element composition connected with high isotropy of cosmic rays are found. (auth)

7949 PROSPECTS AND PROBLEMS FOR EXPERIMENTAL GAMMA RAY LINE ASTRONOMY. Chupp, E. L. pp 355-382 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

Discussed is the status of current experimental knowledge in this field, expected instrumentation improvements that will be carried out in the near future before 1979, and the fundamental problems of background and angular resolution which will seriously limit experiments. High time resolution as well as high energy resolution will also be needed to study possible spectral features in the recently discovered gamma ray bursts. (auth)

7950 NATURE OF GAMMA-RAY EMISSION FROM GALACTIC CENTER REGION. Stepanyan, A. A.; Vladimirskii, B. M.; Neshpor, Yu. I.; Fomin, V. P. pp 383-384 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Technicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The data on the variability of high-energy (> 10^{12}eV) gamma-ray sources as well as upper limit of diffuse flux from Galactic Center region are presented. A comparison of these results with the measurements at the energies about 10^8 eV of different authors is made. A conclusion about the nature of gamma-ray emission enhancement in direction of Galactic Center region is made. (auth)

7951 RESULTS OF COSMIC-RAY INTENSITY MEASUREMENTS MADE BY LUNA-19 AUTOMATIC STATION. Chuchkov, E. A.; Lyubimov, G. P.; Myagchenkova, O. G.; Novichkova, A. D.; Pereslegina, N. V.; Contor, N. N.; Nikolaev, A. G. Cosmic Res. (USSR) (Engl. Transl.); 13: No. 2, 223-232(1975).

Translated from Kosm. Issled.; 13: No. 2, 254-265(1975).

The article surveys the results of measuring the characteristics of the low-energy cosmic rays received by apparatus installed in Luna-19 in the period from September 28, 1971 to August 20, 1972. Principally, proton fluxes with energies of 1-5, 5-10, 10-40, and over 30 MeV were recorded. A short analysis is made, both of the individual events in the cosmic rays and of the general course of their intensity in the period of 1971-1972. Solar and geophysical data were included for the analysis, and also data from other space probes. It is shown that the period of Luna-19's operation matched the second (anomalous) maximum on the decline of solar activity in the course of its 20th cycle. Suggestions are made as to the nature of this maximum. (auth)

7952 RECORDING OF PRIMARY COSMIC RAY ELECTRONS ON COSMOS-490. Basilova, R. N.; Grigorov, N. L.; Kalinkin, L. F.; Pugacheva, G. I.; Savenko, I. A. Cosmic Res. (USSR) (Engl. Transl.); 13: No. 2, 245-246(1975).

Translated from Kosm. Issled.; 13: No. 2, 276-277(1975).

The flux and energy spectrum of electrons with energies $E_e > 10^8$ eV are determined by an instrument mounted on the artificial earth satellite Cosmos-490. (BJG)

7953 HELIOCENTRIC COSMIC RAY GRADIENT 1.0 TO 4.1 AU. Thomsen, M. F. (Univ. of Iowa, Iowa City). pp 217-223 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

The heliocentric radial gradient over the range of 1.0 to 4.1 AU for cosmic rays with energies greater than 80 MeV is derived from data obtained with five detectors on board Pioneer 10. The energy thresholds of the detectors are described, and the data reduction technique is outlined. The gradient is found to be less than or equal to 0.23 percent per AU to within an uncertainty of less than 1 percent per AU. Appended graphs and tables illustrate the obtained data and summarize the corrections made and the possible systematic errors. (IAA)

Stars

Refer also to abstracts 7946, 7950, 8052, 8058–8060, 8063, 8066, 8068, 8070, 8094, 8111, 8157, 8174, 8176, and 8177.

7954 (N-75-13698) MANY-PARTICLE THEORY OF NUCLEAR SYSTEMS WITH APPLICATION TO NEUTRON STAR MATTER. Research Report, 1 December 1973–30 November 1974. Chakkalakal, D. A.; Yang, C. H. (Southern Univ., Baton Rouge, La. (USA). Dept. of Physics). 16 Dec 1974. 25p. NTIS $3.25.

The energy-density relation was calculated for pure neutron matter in the density range relevant for neutron stars, using four different hard-core potentials. Calculations are also presented of the properties of the superfluid state of the neutron component along with the superconducting state of the proton

component, and the effects of polarization in neutron star matter. (STAR)

7955 (N-75-13701) UNUSUAL STARS. Bronshten, V. A. Translated from Priroda; No. 8, 79-87(1974). 28p. (NASA-TT-F-16010). NTIS $3.75.

A discussion is given of eclipsing variable stars. The unusual representatives of these stars are analyzed, including the star RU Monocerotis, and 31 and 32 Cygni. Studies have shown that in the chromospheres of these stars there are condensations from 100 to 10,000 km in extent. (auth)

7956 (N-75-10876) COMPARISON OF LYMAN alpha AND He lambda 10830 LINE STRUCTURES AND VARIATIONS IN EARLY-TYPE STAR ATMOSPHERES. Final Technical Report, January-October 1974. Meisel, D. D. (State Univ. of New York, Genesco (USA). Department of Physics and Astronomy). Oct 1974. 27p. (NASA-CR-140572). NTIS $3.75.

Line profiles were first obtained at maximum velocity separation of the spectroscopic binary Spica (alpha Vir), and then high resolution spectrophotometric images of selected features in the 1.1 micron spectrum of Comet Kohoutek were obtained in order to gain insight into the structures and variations in early-type star atmospheres. (auth)

7957 (N-75-18135) GLOBULAR STAR CLUSTERS. Kukarkin, B. V. Feb 1975. Translated from pp 4-136 of Sharovye Zvezdne Skopleniya, Obshchiy Katalog Sharovykh Zvezdnykh Skopleniy Nashey Galaktiki, Soderzhashchiy Privedennye k Edinoy Sisteme Kharakteristiki 129 Obektov, Nauka Press, Moscow, 1974. (NASA-TT-F-16157). 155p. NTIS $6.25.

Different physical characteristics of globular star clusters of our galaxy, obtained from observations performed at different astronomical observatories throughout the world are examined. The first part presents the investigations of different observations and formulas for reducing the observations to a uniform system. The second part gives a catalog of all the globular clusters of all galaxies which are known at the present time, and presents their characteristics in a uniform system with an indication of the sources. The book is designed for specialists in astronomy, students, and aspirants studying astronomy. (auth)

7958 (N-75-21164) ASTROMETRICS AND ASTROPHYSICS, NO. 17. Koval, I. K. (ed.). Dec 1974. Translation of Astrometriya i Astrofizika, 17, Naukova Press, Kiev, 1972. (NASA-TT-F-15768). 151p. NTIS $6.25.

Articles are presented on stellar physics, solar physics, photographic astrometrics, and fundamental astronomy. Topics discussed include hydrogen envelope of a white dwarf, sound waves, spectral lines, thermodynamic equilibrium, astronomical refraction, scintillation spectra of stars and planets, light beam direction fluctuations, and operator response characteristics. For individual titles, see N75-21165 through N75-21173. (STAR)

7959 THERMAL DAMPING CONSTANTS AND THEIR CONSTITUENTS FOR HYDROGEN. Sapar, A.; Kuusik, I.; Einasto, L. Publ. Tartu. Astrofiz. Observ.; 42: 223-271(1974).

Primary emphasis is on the investigation of inelastic and superelastic, i.e. of nonisoenergetic transition rates, caused by thermal electron collisions and photon impacts, both of them giving the thermal excitation, de-excitation and ionization rates as the constituents of the damping constant, computed values of which are given in tables and plotted in figures. The role of these constituents for different physical conditions is estimated. (28 figs, 7 tables, 10 refs) (GHT)

7960 ATLAS OF STAR CLUSTERS WITH COLOR MAGNITUDE DIAGRAMS IN THE MAGELLANIC CLOUDS. Alcaino, G. Astron. Astrophys., Suppl. Ser.; 21: No. 3, 279-406 (Sep 1975).

On a uniform scale the color magnitude diagrams of 30 of the most spectacular star clusters in the LMC and 6 in the SMC are presented together with the magnitudes and colors of the stars with their identification charts. The photometric data and finding maps of 13 selected photoelectric sequences in the LMC and 9 in the SMC are included. Tables with basic data are listed for 162 of the most conspicuous star clusters in the LMC and 116 in the SMC, and for 42 photoelectric sequences in the LMC and 22 in the SMC. (auth)

7961 COPERNICUS: THE SPATIAL DISTRIBUTION OF THE X-RAY EMISSION FROM IC443. Charles, P. A.; Culhane, J. L.; Rapley, C. G. (University Coll., London). Astrophys. Lett.; 16: No. 3, 129-132(1975).

The MSSL X-ray instrumentation on the Copernicus satellite has observed the spatial structure of the supernova remnant IC443. We find the soft (0.5-1.4 keV) X-ray emission to be strongly correlated with the bright optical filaments in the northeast. The total intensity is consistent with previous observations of the remnant. An upper limit of 4.10^{-11} erg cm^{-2} s^{-1} can also be assigned to the flux in the 0.5-1.4 keV band from the nearby pulsar PSR 0611 + 22. (auth)

7962 TIME LAG EFFECTS IN THE NUCLEATION OF PARTICLES IN STELLER ATMOSPHERES. Walker, G. H. (Clark Coll., Atlanta). Astrophys. Lett.; 16: No. 3, 115-120 (1975).

When a system goes from a saturated state to a supersaturated one, the classical nucleation rate formula is not instantly valid; rather, the nucleation rate relaxes exponentially (with a characteristic time—the time lag) to the value given by the steady state formula. Under some circumstances, particularly those found in some cool, stellar atmospheres, the time lag can be quite long and a decisive factor in determining the possibility of particle formation. Carbon condensation in the atmospheres of Mira variables is considered and found to be unlikely on the basis of classical nucleation theory because of the long time lags involved unless the parameters describing the physical conditions in these atmospheres are significantly different from current estimates. (auth)

7963 RADIOACTIVE TRANSFER IN A STRONG MAGNETIC FIELD AND ACCRETING X-RAY PULSARS. Basko, M. M.; Sunya, R. A. (Space Research Inst., Moscow). Astron. Astrophys.; 42: No. 3, 311-321(Sep 1975).

The problem of radiative transfer in an atmosphere with a strong magnetic field is solved, and the results are presented in this paper. The mechanism being discussed can account also for the beamed and polarized radiation of white dwarfs having a strong magnetic field. In the framework of the theoretical model adopted, an upper limit is obtained for the luminosity of X-ray pulsars, which can greatly exceed the Eddington critical value per unit surface area. The luminosity of X-ray pulsars is limited by distortion of the beam pattern due to the scattering of emitted X-rays by the electrons of the infalling gas. (auth)

7964 INFRARED SPECTRUM OF THE CARBON STARS UU AUR AND YCVn FROM 4000 TO 6800 cm^{-1}. Querci, M.; Querci, F. (Observatoire de Paris, Meudon, France). Astron. Astrophys.; 42: No. 3, 329-340(Sep 1975).

The infrared spectra of the carbon stars UU Aur and YCVn at 0.3 cm^{-1} resolution are presented in several selected regions from 4000 to 6800 cm^{-1}. We have identified the dominant features of the CO, CN, and C_2 molecules and some atomic features. The line positions are corrected for the Doppler shift due to the apparent radial velocity. However, an accurate identification line-by-line is sometimes prevented by the heavy blending from telluric lines; we have attempted to roughly correct the spectra for atmospheric extinction according to the available observational material. The identification is also impeded in some spectral ranges by the lack of laboratory wavenumbers and of adequate molecular constants. (auth)

7965 CONDITIONS OF PERSISTENCE FOR OLD STELLAR GROUPS. Gomez, A. E.; Mayer, F. (Observatoire, Geneva). Astron. Astrophys.; 42: No. 3, 341-346(Sep 1975).

The proposition given by Innanen and House (1970) to explain the persistence of old stellar groups in terms of successive close mutual approaches of stars having a common origin is tested systematically by numerical integration of orbits in Schmidt's (1965) potential. We used the method of the surface of section (ϖ,$\dot{\varpi}$) to distinguish between the various types of orbits: tube, box, semi-ergodic. The conditions for the persistence of approaches are very restrictive: the dispersion of the energy and of angular momentum among the stars of a group must be very small, and close approaches are present only for particular initial conditions, related with the "third" integral of motion. Observed old groups do not fill these conditions. (auth)

7966 REDISTRIBUTION PERTURBATIONS IN RADIATIVE TRANSFER THEORY. Cannon, C. J.; Lopert, P. B.; Magnan, C. (Institud d'Astrophysique, Paris). Astron. Astrophys.; 42: No. 3, 347-353(Sep 1975).

A new technique is developed which enables the fast, efficient and accurate numerical solution of the equation of transfer for spectral line radiation in which the redistribution of both photon angle and frequency at a photon scattering event is incorporated. The method is quite general and may be used in conjunction with any of the presently available numerical methods of solution. In particular, we formulate the technique for both the integro-differential and integral representations of the transfer equation. The essence of the technique is to start with a zero order solution obtained from the equation of radiative transfer in which complete redistribution holds. The first and higher order terms are then obtained from a perturbation series which is shown to converge extremely quick. When combined with angle and frequency

quadrature perturbations the method allows a considerable saving in computer time and storage. Further, the use of a complete redistribution zeroth order solution enables the application of numerical methods for solving the transfer equation which takes advantage of the symmetries and simplifications of a frequency independent line source function. The technique therefore has significant advantages for problems in which redistribution plays a fundamental role. (auth)

7967 DISTRIBUTION OF MASSES, AGES, AND LUMINOSITIES OF POPULATION I FIELD GIANTS. Neckel, H. (Hamburger Sternwarte, Hamburg). Astron. Astrophys.; 42: No. 3, 379-393(Sep 1975).

The initial luminosity function, the time dependence of the stellar birth rate and the lifetimes of the stars on the main sequence as well as in the giant region determine the space density and mass spectrum of the field giants in the solar neighborhood. The predicted mass spectrum exhibits a very pronounced maximum for stars with masses only slightly exceeding one solar mass, which were born on the main sequence in the first stages of star formation. The resulting space density ($6.3 \cdot 10^{-4}$ pc^{-3}) is in fair agreement with the values deduced from star counts. The predicted magnitude dispersion as well as the predicted position of the field giant branch in the HR-diagram agree well with the results which follow from a recalibration of the Mt. Wilson spectroscopic absolute magnitudes by means of the Wilson–Bappu effect. (auth)

7968 GRID OF MODEL ATMOSPHERES FOR METAL-DEFICIENT GIANT STARS. I. Gustafsson, B. (Uppsala Univ.); Bell, R. A.; Eriksson, K.; Nordlund, A. Astron. Astrophys.; 42: No. 3, 407-432(Sep 1975).

A grid of flux-constant model atmospheres for stars with $3750\ \mathrm{K} \leqq T_{\mathrm{eff}} \leqq 6000\ \mathrm{K}$, $0.75 \leqq \log g \leqq 3.0$ (cgs units) and $-3.0 \leqq [A/H] \leqq 0.0$ has been constructed. The line absorption is approximated by opacity distribution functions; this procedure is shown to be quite satisfactory. Metal lines and molecular lines, including those from the infrared bands of CO and CN, are taken into account. The variation of the structure of the models with metal abundance and microturbulence parameter is found to be quite regular and not very drastic. The surface cooling produced by CO is important for all the models with $T_{\mathrm{eff}} \leqq 5000$ K, while CN mainly causes a backwarming effect but is not very important for solar CNO abundances. The effects of convection, estimated using the mixing-length approximation, are important only for the coldest models. The models compare very well with models from overlapping regions of other grids. A solar model consistent with the grid models is found to agree satisfactorily with empirical solar model atmoshperes. The careful use of scaled solar models for stars with $[A/H] \approx 0$ is justified. The uncertainties of the models are studied in some detail. Conclusions are also drawn concerning the validity of Peytremann's statistical method. (auth)

7969 COMPUTATION OF MINIMUM TIMES OF LIGHT CURVES. Van Diest, H. (Royal Observatory, Brussels). Astron. Astrophys.; 42: No. 3, 465-466(Sep 1975).

Minimum epochs for periodically variables are derived from cubic Vondrak-spline fits. Obtained results are compared with those from previous methods. (auth)

7970 EVIDENCE FOR A ROTATIONAL REDDENING IN EARLY B-TYPE STARS. Maeder, A. (Observatoire, Geneva). Astron. Astrophys.; 42: No. 3, 471-473(Sep 1975).

It is shown that rapid rotation produces an intrinsic reddening of about $0^{m}.04-0^{m}.06$ for early B-type stars. It is suggested that this effect can be interpreted in terms of recent models of extended stellar atmospheres. (auth)

7971 BLACK HOLE. Wheeler, J. A. (Princeton Univ., NJ). pp 279-316 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

The phenomenon of a black hole is described with reference to the three levels of gravitational collapse, the three parameters which uniquely specify the properties of a black hole, and the three signals from a black hole. The process of collapse to a black hole is described for a uniform spherically symmetric cloud of dust and is compared and contrasted with the final collapse of the universe. Quantum fluctuations in the geometry of spacetime are analyzed as a kind of gravitational collapse going on all the time and everywhere at small distances. It is shown why mass, charge, and angular momentum are the only parameters which fix the properties of a Kerr–Newman black hole at the classical level and how the baryon and lepton numbers are transcended in black-hole physics. Particle motion and wave propagation in black-hole geometry are analyzed, and it is shown that a black-hole will give out three signals: gravitational radiation at the time of formation, X-rays from accretion after formation, and "activity" produced by release of rotational energy. (IAA)

7972 SEARCH FOR OBSERVATIONAL EVIDENCE FOR BLACK HOLES. Novikov, I. D. (Inst. of Applied Mathematics, Moscow). pp 317-347 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

Properties of black holes are discussed which can aid in locating them in the universe. The origin of stellar black holes is recounted, and the problem of black hole invisibility is considered. The most important observational properties are shown to be luminosity due to accretion of interstellar gas and X-rays emitted during accretion in close binary systems. The Uhuru X-ray observations of Cyg X-1 and SMC X-1 are presented as likely evidence of the presence of black holes in those systems. The existence of black holes in globular star clusters is assessed, and it is suggested that galactic nuclei must contain supermassive black holes or some other unusual objects. (IAA)

7973 EVOLUTIONARY ORIGIN OF MASSIVE X-RAY BINARIES AND THE TOTAL NUMBER OF MASSIVE STARS WITH A COLLAPSED CLOSE COMPANION IN THE GALAXY. van den Heuvel, E. P. H. (Vrije Univ., Brussels). pp 119-133 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

7974 OBSERVING NEUTRON STARS: INFORMATION ON STELLAR STRUCTURE FROM PULSARS AND COMPACT X-RAY SOURCES. Pines, D. (Univ. of Illinois, Urbana). pp 147-175 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

Observations of the Crab and Vela pulsars and Her X-1 are combined with theoretical interpretations of observed physical phenomena to distinguish between different types of neutron stars and to calculate their physical parameters. The masses and internal structures of the two pulsars are determined from observations of their luminosities, short-term variations in their pulse frequencies, and long-term variations in their pulse signals. The nature and behavior of their macroglitches, starquakes, and free precessions are investigated, and it is shown that the Crab pulsar probably has a liquid core, while Vela probably has a solid core. The mass and internal structure of Her X-1 are inferred from the period and Doppler shift of its X-ray pulses, the star is assumed to have a solid core, and the magnitude of its free precession is calculated. Possible pumping mechanics for free precession of neutron stars are investigated, and it is concluded that the most likely mechanism is electromagnetic torque associated with magnetic dipole radiation. (IAA)

7975 ACCRETION ONTO MAGNETIC NEUTRON STARS: COMMENTS ON THE POSITION OF THE ALFVEN SURFACE. Lamb, F. K. (Univ. of Illinois, Urbana); Pethick, C. J. pp 135-141 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

Criteria are discussed which have been proposed for determining the Alfven radius of an accreting neutron star. Equations are presented for determining the Alfven radius in the cases of radial inflow of matter towards a nonrotating neutron star, a star which is rotating or accreting matter with finite angular momentum, a star which is rotating rapidly or has an accretion disk extending all the way into the Alfven surface, and a star with a fully developed thin Keplerian disk extending all the way into the Alfven radius. The effects of viscous and magnetic torques and the role of the critical stellar angular velocity are analyzed as causes of spinup or spindown in the rotation of a neutron star. (IAA)

7976 PHYSICS OF HIGH DENSITY AND NUCLEAR MATTER. Pandharipande, V. R. (Univ. of Illinois, Urbana). pp 177-219 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

The physics of cold matter is investigated at densities likely to occur in neutron stars. Nuclear potentials at subnuclear and high densities are analyzed, and the Brueckner-Bethe-Goldstone theory of nuclear matter energy interactions is described. Results are reviewed for calculations of the behavior of dense neutron matter, the magnetic susceptibility of such matter is analyzed,

and its equation of state is outlined. Interactions are examined which may solidify neutron matter in the investigated density ranges. The composition of hyperonic matter is described, models are presented for baryon interactions, and minimal relativity corrections are derived for energy interactions at nuclear matter densities. Pion interactions and condensation are analyzed, and the behavior of matter at subnuclear densities is investigated, with particular attention given to neutron drip. The theoretical calculations are compared with some experimental data obtained from observations of the Crab and Vela pulsars. (IAA)

7977 ASTROPHYSICS AND GRAVITATION: PROCEEDINGS OF THE SIXTEENTH SOLVAY CONFERENCE ON PHYSICS HELD AT BRUSSELS, BELGIUM, SEPTEMBER 24–28, 1973. Brussels; Editions de l'Universite de Bruxelles (1974). 506p. $51.00.

Topics such as pulsars and neutron stars, black holes, the physics of high density and nuclear matter, binary and compact galactic x-ray sources, determination of optical companions of compact x-ray sources in binary systems, theories of quasars, distribution of quasars in the universe, and developments in burst astronomy are considered. It is shown how information about the structure of neutron stars can be derived from observations of pulsars and compact X-ray sources. Evidence is presented for nonvelocity redshifts and the relativistic effects of gravitational radiation. (IAA)

7978 NEUTRON STARS, BLACK HOLES, AND BINARY X-RAY SOURCES. Ruffini, R. (Princeton Univ., NJ). pp 349-424 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

A general overview is presented of neutron stars, black holes, binary X-ray sources, and gravitational collapse. Physical and energetic processes and mechanisms of neutron stars and black holes are described in detail, with special attention given to gravitational effects. Detection of gravitational radiation produced in extreme relativistic regimes is analyzed, and programs are described which have been undertaken to detect gravitational radiation and collapse. Criteria are presented for differentiating between neutron stars and black holes, including the value of their masses, the structure of their magnetospheres, and the type of X-ray emissions from binary X-ray sources. Regularly pulsating and bursting X-ray sources are analyzed, and the case of Cyg X-1 is described in detail. The physics of white dwarfs in contact binary systems is compared with that of collapsed objects in an attempt to clarify the role of white dwarfs in the formation of collapsed objects. (IAA)

7979 LOW-VELOCITY M-DWARFS EXPLAINED BY VERY LOW-MASS STARS. Staller, R. F. A. (Univ. of Amsterdam). Astron. Astrophys.; 42: No. 1, 155-157(Aug 1975).

It is suggested that the M-dwarfs with a low velocity dispersion (some 50% of the M-dwarfs near the galactic North Pole) might be contracting stars with masses between 0.01 $M_\odot$ and 0.07$M_\odot$. Contraction tracks of such stars pass through the M spectral region and the total duration of their contraction and cooling (before becoming invisible) is of the order of 5×10^8 to 10^9 yrs. If this hypothesis is correct the number of black dwarfs in the Galaxy must be at least some 10 to 20 times the number of low velocity dispersion M-dwarfs. (auth)

7980 NEW ABSORBING ENVELOPE OF 59 CYGNI. Doazan, V.; Briot, D.; Bourdonneau, B. (Observatoire de Paris). Astron. Astrophys.; 42: No. 1, 161-162(Aug 1975). (In French)

In June 1973, the spectrum of 59 Cyg shows deep and sharp absorption lines, characteristic of shell stars and of the α Cygni type. It is the first time that such a spectrum is observed for this star. In March 1975, the shell absorption spectrum has considerably faded and in particular, the metallic absorption lines have completely disappeared. (auth)

7981 PROPERTIES AND NATURE OF SHELL STARS. V. Redetermination of the Velocity Curve of 4 Her. Heard, J. F. (David Dunlap Observatory, Richmond Hill, Ont.); Hurkens, R.; Harmanec, P.; Koubsky, P.; Krpata, J. Astron. Astrophys.; 42: No. 1, 47-53(Aug 1975).

A period of 46.194 ± 0.002 days for the radial velocity variation of 4 Her is supported by both visual and oscilloscope measurements of 159 old and new Dunlap, Ondrejov and Victoria spectrograms of the star. It thus appears that the period has remained constant over the past forty years. A period close to one day has been definitely ruled out. The orbital elements presented here are based upon the seemingly justifiable assumption of the binary nature of the star, but distortion of the elements by gas streaming is strongly indicated. (auth)

7982 PERIOD CHANGES IN BINARY SYSTEMS DURING THE WOLF–RAYET STAGE. De Greve, J. P.; De Loore, C. (Univ., Brussels). Astron. Astrophys.; 42: No. 1, 91-94(Aug 1975).

Wolf–Rayet stars lose mass at a rate of 10^{-6} to 10^{-5} $M_\odot$ yr^{-1}. If the Wolf–Rayet star is a member of a binary system this mass loss can be sufficiently large to cause observable changes in the binary period. Computations were performed in order to estimate these changes (of mass ratios and periods) by assuming a Jeans-like mode of loss of mass and angular momentum. The thus computed period increase for V444 Cyg is in good agreement with the value observed by Khaliullin. It is argued that Wolf–Rayet binaries originate from a very small region of the HR diagram. Evidence is presented suggesting that the Wolf–Rayet binary HD 228766 has already lost a considerable amount of its mass (>15%). (auth)

7983 WHITE DWARF EXTERNAL LAYERS. II. Convection and Magnetic Fields. D'Antona, F. (Osservatorio Astronomic, Rome); Mazzitelli, I. Astron. Astrophys.; 42: No. 1, 127-129(Aug 1975).

It is shown that, in a white dwarf, a magnetic field of the order of several thousands Gauss can have a strong influence on the behavior of subatmospheric convection and, for cool stars, even on the cooling time. (auth)

7984 RELATIONS BETWEEN LUMINOSITY, PERIOD, AND METALLICITY IN RR LYRAE STARS. Heck, A. (Univ., Liege). Astron. Astrophys.; 42: No. 1, 131-133(Aug 1975).

We present here the results of the calibration of relations between the luminosity and the period on the one hand, and between the luminosity and the metallicity index ΔS (Preston, 1959) on the other hand for two samples of RR Lyrae stars: one of 134 stars of mixed types and one of 121 stars of Bailey-types a and b only. All the stars have period greater than $0^d.2$. The calibration algorithm is based on the principle of maximum likelihood. The best relations, among the considered possibilities, are those which include the metallicity index and we retain $M_v^{(1)} = -0.51 (\pm 0.21) + 0.21(\pm 0.02)\Delta S^{(1)}$ for the sample of 134 stars and $M_v^{(1)} = -0.26(\pm 0.19) + 0.17(\pm 0.05)\Delta S^{(1)}$ for the sample of 121 stars of types a and b. (auth)

7985 PROCESSIONAL PERIOD IN U CEPHEI. Walter, K. (Univ., Tuebingen, Ger.). Astron. Astrophys.; 42: No. 1, 135-138(Aug 1975).

From photometric observations of the light during total eclipse in primary minimum, obtained by many observers between 1880 and 1970, a period of 12.0 years is derived. It is suggested that this period be identified with the precessional period of the rotational axis of the B component. (auth)

7986 PULSARS: A PROGRESS REPORT. Pacini, F. (CNR, Frascati, Italy). pp 1-26 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

An overview is presented of what is currently known about pulsars. The main characteristics of pulsars are summarized, and the basic mechanisms by which a neutron star can convert rotational energy into the energy of relativistic particles and magnetic fields are analyzed. Models of pulsar radiation mechanisms are described, including those which attempt to explain the origin of pulsations, the coherence of emitted radiation, and pulsar polarization behavior. The overall relationship between pulsars and supernovae remnants is analyzed with the example of the Crab Nebula by discussing the nature and evolution of the evolution of the nebular magnetic field, the expansion of supernova shells, and the evolution of the luminosity of supernovae remnants. (IAA)

7987 NEUTRON STARS: GENERAL REVIEW. Cameron, A. G. W. (Smithsonian Astrophysical Observatory, Cambridge, MA); Canuto, V. pp 221-278 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

A review is presented of those properties of neutron stars upon which there is general agreement and of those areas which currently remain in doubt. Developments in theoretical physics of neutron star interiors are summarized with particular attention devoted to hyperon interactions and the structure of interior layers. Determination of energy states and the composition of matter is described for successive layers, beginning with the surface and proceeding through the central region into the core. Problems encountered in determining the behavior of matter in the ultra-high density regime are discussed, and the effects of the magnetic field of a neutron star are evaluated along with the behavior of atomic structures in the field. The evolution of a

neutron star is outlined with discussion centering on carbon detonation, cooling, vibrational damping, rotation, and pulsar glitches. The role of neutron stars in cosmic-ray propagation is considered. (IAA)

7988 ABSOLUTE ROCKET PHOTOMETRY OF γ-ORI IN THE VUV-REGION. Hessberg, H.; Niekerke, J.; Stephan, K. H. (Max-Planck-Institut fuer Extraterrestrische Physik, Garching, Ger.). Astron. Astrophys.; 42: No. 3, 395-406(Sep 1975).

In autumn 1973 the absolute photon flux of γ-Ori (HD No. 35468, B2 III, $m_v = 1.64$) was measured with two rocket-borne photometers in the wavelength region from λλ 1250 to 3000 Å. The bandwidth was 100 resp. 200 Å. The photometers were calibrated before flight with blackbody radiation. The results, having uncertainty values of ±25%, are compared with model calculations and previous measurements. Two recent model calculations for line blanketed stellar atmospheres are strongly supported longward of 1500 Å by the presented measurements. Model comparison yields an effective temperature of $T_{eff} = 24600°K$ with log g = 4.0. Compared to previous measurements the present results are in general above all other values down to 1500 Å. Below 1500 Å they present the lower limit of all so far measured values and are in disagreement with theories. Detailed critical discussion hints to unknown circumstellar or interstellar variation effects rather than to instrumental failure. The star γ-Ori may be taken confidently as a secondary standard with the present values down to 1500 Å. Below 1500 Å it should not serve as standard unless the source of discrepancies will be cleared up. (auth)

7989 FOUR-COLOR PHOTOMETRY OF ECLIPSING BINARIES. I. HS Hya, Light Curves, Photometric Elements, and Determination of Helium Content. Glydenkerne, K.; Joergensen, H. E.; Carstensen, E. (Copenhagen Univ.). Astron. Astrophys.; 42: No. 3, 303-309(Sep 1975).

Photometric elements are derived for the eclipsing binary HS Hya. Using published spectroscopic elements the absolute dimensions are derived. A comparison with new stellar model calculations was carried out and the helium content of HS Hya was found to be Y = 0.22 ± 0.04. (auth)

7990 EFFECT OF RIGIDITY ON NONRADIAL OSCILLATIONS. Denis, C. (Univ., Liege). Mem. Soc. R. Sci. Liege; 8: 253-257(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The spheroidal spectrum of a solid sphere is composite; it is composed of different spectra emitted from the p, f, and g spectra of the fluid sphere. When the rigidity modulus is nonzero (even if it is very low), the spectrum emitted by a g spectrum has an accumulation point at +∞, just as that emitted by the p spectrum. The different spectra are then overlapped and certain modes can then interact. (tr-auth)

7991 X-RAY SOURCES AND THE PULSATIONAL PROPERTIES OF HIGH LUMINOSITY DEGENERATE STARS. Sion, E. M.; Vila, S. C. (Univ. of Pennsylvania, Philadelphia). Mem. Soc. R. Sci. Liege; 8: 227-231(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Models of high luminosity degenerate stars have been calculated in which nuclear burning at the base of the envelope provides the total luminosity of the model. The pulsation periods, radial eigenfunctions, pulsational properties and stability have been calculated for the fundamental and first harmonic modes. The applicability of the results to Cen X-3 and Her X-1 as accreting, pulsating white dwarf binary components is discussed. (auth)

7992 VIBRATIONAL STABILITY OF RELATIVISTIC SUPERMASSIVE STARS IN THE PRE-MAIN-SEQUENCE CONTRACTION STAGE. Demaret, J. (Univ., Liege). Mem. Soc. R. Sci. Liege; 8: 233-242(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

A general relativistic extension of a formula for the vibrational stability coefficient of classical stars in thermal imbalance is applied to the case of non-rotating supermassive stars ($10^5 M_\odot < M < 10^6 M_\odot$) in the pre-main-sequence contraction stage. Apart from its astrophysical interest, this case provides an example of a situation where the "thermal-imbalance" terms are essential as, without these terms, the star is practically in a state of marginal equilibrium as regards vibrational stability. (26 refs) (auth)

7993 PULSATIONAL STABILITY OF STARS IN THERMAL IMBALANCE. Aizenman, M. L.; Cox, J. P. (National Bureau of Standards, Boulder, CO). Mem. Soc. R. Sci. Liege; 8: 243-245(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

A brief summary is given of recent work on the pulsational stability of stars in thermal balance (i.e., stars which in their nonpulsating states are in hydrostatic, but not thermal, equilibrium). (12 refs) (GHT)

7994 VIBRATIONAL STABILITY OF EVOLVING STARS. Davey, W. R. (Univ. of Queensland, St. Lucia, Australia). Mem. Soc. R. Sci. Liege; 8: 247-249(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The vibrational stability of quasi-statically evolving stars (i.e. stars which are in hydrostatic but not thermal equilibrium) has recently been investigated using four separate lines of attack: (1) the small perturbation approach; (2) an energy approach; (3) an asymptotic approach; and (4) direct solutions of the appropriate differential equations. The theoretical formalisms developed in a series of investigations by Aizenman, Cox, Davey, and Hansen have been applied to several simplified examples of stars executing quasi-adiabatic radial oscillations. In all cases that we have examined, each of the four methods produces identical results. Integral expressions are presented in a very simple form for computing stability coefficients. In our opinion this is the most general and computationally convenient procedure for testing the pulsational stability of stars in thermal imbalance. (auth)

7995 NONRADIAL OSCILLATIONS IN MASSIVE STARS DURING CORE H-BURNING PHASE. Chiosi, C. (Univ., Padua). Mem. Soc. R. Sci. Liege; 8: 259-272(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The results of numerical integration of the second order differential equation for the adiabatic nonradial oscillations of quadrupole ($\ell = 2$) for evolutionary models of massive stars during the core H-burning phase are presented. The oscillations have been tested for pulsational stability and several g_+ modes are found to be unstable. (5 figs, 3 tables, 20 refs) (auth)

7996 EXCITATION OF NONRADIAL OSCILLATIONS BY PARTIAL IONIZATION ZONE MECHANISM. Dziembowski, W. (Inst. of Astronomy, Warsaw). Mem. Soc. R. Sci. Liege; 8: 287-297(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Complete stellar models corresponding to mean states of various pulsating variables were tested for vibrational stability against nonradial modes by means of the linear nonadiabatic analysis. It is shown that only some of pulsating horizontal branch stars are unstable and even then the excitation of nonradial modes is unlikely as the amplitude growth rates are much lower than those for radial modes. The main sequence stars that are unstable against radial modes are simultaneously unstable against many nonradial modes with similar growth rates. In the case of early main sequence phase this remains true also for modes associated with spherical harmonics of higher orders ($\ell \sim 10$). (3 tables, 6 figs) (auth)

7997 EPSTEIN'S WEIGHTING FUNCTION AND PULSATION CONSTANTS OF CEPHEID MODELS. Petersen, J. O. (Univ. of Copenhagen). Mem. Soc. R. Sci. Liege; 8: 299-305 (1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

For a series of Cepheid models Epstein's weight functions are discussed, and it is found useful to consider also the normalization functions, which have a similar character. It is shown that the increase in Q_0 with increasing luminosity is due mainly to changes in the structure of the models and effects from the radiation field, while the direct effects of ionizations are small. (2 figs, 1 table) (auth)

7998 NUMERICAL MODELS WITH OVERSHOOTING OF CONVECTIVE CORES. Maeder, A. (Observatoire, Geneva). Mem. Soc. R. Sci. Liege; 8: 327-333(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Detailed models of stellar interiors have been computed, in which the use of the Schwarzschild criterion for determining the limit of the convective core is replaced by a simultaneous integration of the equations of the stellar structure and of the equation of motion of a mean ascending bubble. A preliminary report on this work is given . (1 fig, 1 table) (auth)

7999 PRELIMINARY RESULTS OF DETAILED HELIUM SHELL FLASH CALCULATIONS. Christy-Sackmann, I. J.

(California Inst. of Tech., Pasadena); Paczynski, B. Mem. Soc. R. Sci. Liege; 8: 335-353(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Up to now, ten successive flashes have been followed for population I stars of 3 and 3.3 $M_\odot$. The flashes are still increasing in strength, consisting of up to 5 subcomponents separated from the main flash on the order of 5, 20, 50 and 800 years, respectively. The core mass M_c of the degenerate carbon-oxygen core seems to determine the interflash period and the intershell mass M_{is}, M_c growing by an amount M_{is} in 8 flashes for the 3 $M_\odot$ star and 3 flashes for the 6 $M_\odot$ star. The flashes of the 3 and 3.3 $M_\odot$ stars seem to become similar when compared at similar core masses. The bottom of the hydrogen layers has been approached very closely by both the flashdriven intershell convective region and by the outer convective envelope, the former approach occurring approximately 30 years, the latter approximately 400 years after peak flash, the former approach being within 2×10^{-4} $M_\odot$ in mass, a factor of 1.8 in density; the latter approach being within 2×10^{-4} $M_\odot$ in mass. The burning of helium during the flash produces primarily ^{12}C and little ^{16}O. (18 figs, 3 tables, 17 refs) (auth)

8000 STELLAR MASS LOSS. Lucy, L. B. (Columbia Univ., New York). Mem. Soc. R. Sci. Liege; 8: 359-365(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Stars losing mass at a rate that may prove of significance for their evolution are discussed, with emphasis on the mechanisms responsible for the outflows and on the possibility of obtaining theoretical mass loss rates. Considerable attention is paid to the mass loss rate for ζ Puppis (O5f) since theoretical estimates differ by a factor of 100. (25 refs) (auth)

8001 CIRCUMSTELLAR ABSORPTION LINES AND MASS LOSS FROM RED GIANTS. Reimers, D. (Univ., Kiel). Mem. Soc. R. Sci. Liege; 8: 369-382(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Mass losses from red giants are rediscussed on the basis of new observations. Ionization effects and the run of the expansion velocity with the distance from the star have been found to be important for the interpretation of circumstellar CaII lines of M giants and have been determined roughly. Deutsch's rates of mass loss from early M giants have been increased by up to a factor of 10^3. A compilation of all available data shows that mass loss from red giants varies with basic stellar parameters as $\dot{M}\ [M_\odot/yr] = 4.10^{-13}\ L/g \cdot R$ (solar units) in the range 10^{-5} to 10^{-9} $M_\odot$/yr, with an uncertainty of a factor of at least 2 either way. Mass losses from red giants are shown to satisfy evolutionary requirements for Population II and low mass Pop. I stars. For massive stars ($M \gtrsim 3\ M_\odot$), either additional mass loss phases or an upward shift of the absolute scale of mass losses by a factor of 3 are required. (8 figs, 1 table, 30 refs) (auth)

8002 MASS LOSS BY STELLAR WIND IN RED GIANTS AND SUPERGIANTS. Fusi-Pecci, F.; Renzini, A. (Univ., Bologna). Mem. Soc. R. Sci. Liege; 8: 383-390(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

For a long time a mechanism of mass loss similar to the solar wind has been suspected to be operating in all stars having a convective envelope. We have computed for a number of envelope models (with various masses, luminosities, effective temperatures and compositions) the quantity $\dot{\mu} = R\ L_{ac}/GM$, where R and M are the stellar radius and mass respectively and L_{ac} is the total energy in acoustic waves generated per second within the convective envelope. The quantity $\dot{\mu}$ represents the mass loss rate if the acoustic energy were completely used to remove matter from the stellar surface at the escape velocity. The actual value of the mass loss rate is assumed to be equal to $\eta\dot{\mu}$ where η is an "efficiency" parameter which turns out to be about 8×10^{-4} in the case of the sun according to the observed values of the mass loss rate due to the solar wind. It is shown that a nearly constant efficiency close to the solar value accounts for the required mass loss rate in population II red giants, in intermediate mass ($2 \div 8$ $M_\odot$) double shell burning stars, as well as in massive red supergiants. (3 figs, 23 refs) (auth)

8003 IS A DWARF NOVA REALLY A DWARF NOVA. Sparks, W. M. (Goddard Space Flight Center, Greenbelt, MD); Starrfield, S. Mem. Soc. R. Sci. Liege; 8: 407-412(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Since it is observed that the constituents of dwarf and common novae binary systems are similar, it has been commonly assumed that the mechanisms are the same varying only in the intensity of the outburst. Our published work shows that a thermonuclear runaway in the hydrogen-rich envelope of a carbon-oxygen white dwarf is responsible for the common nova outburst as long as the CNO nuclei are enhanced. We report here on less energetic thermonuclear runaways which eject no material and produce a rapid luminosity rise that levels off on a short time scale. However, the luminosity increase is much too large for a dwarf nova. Several suggestions for reducing the luminosity peak are presented. (4 figs, 13 refs) (auth)

8004 ACCRETION AND THE NOVA OUTBURST. Starrfield, S. G. (Arizona State Univ., Tucson); Sparks, W. M.; Truran, J. W. Mem. Soc. R. Sci. Liege; 8: 413-424(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Models of thermonuclear runaways in the hydrogen rich envelopes of carbon-oxygen white dwarfs have been shown to reproduce the gross features of the nova outburst. The evolution was begun with the hydrogen envelope in place and in equilibrium, neglecting the effects of accretion in the calculations. New evolutionary sequences that include the infalling material and allow the initial envelope to be out of equilibrium are presented. These models also reproduce the gross features of the nova outburst. (6 figs, 3 tables) (GHT)

8005 THEORETICAL DISCUSSION OF THE BINARY SYSTEM AS ERIDANI. Refsdal, S.; Roth, M. L.; Weigert, A. (Hamburger Sternwarte, Hamburg). Mem. Soc. R. Sci. Liege; 8: 431-433(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Starting from the very accurate observational data of the system, its present evolutionary stage and its past and future evolution are discussed. Special emphasis is given to a possible loss of mass and angular momentum from the system. The present paper summarizes the basic results, while the extensive calculations will be described elsewhere. (auth)

8006 GRAVITATIONAL COLLAPSE OF NONSPHERICAL GAS CLOUDS. McNally, D. (London Univ.). Mem. Soc. R. Sci. Liege; 8: 479-486(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Gravitational collapse of non-spherical gas clouds is shown to lead to a flattened system. The effects of rotation are assessed and it is concluded that rotation may not be a severe problem in star formation and may even be advantageous in promoting fragmentation. The consequences for star formation are examined. (auth)

8007 DYNAMICAL PROBLEMS OF PRE-MAIN SEQUENCE EVOLUTION. Larson, R. B. (Yale Univ., New Haven). Mem. Soc. R. Sci. Liege; 8: 451-464(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

An overview is given of some of the many dynamical phenomena associated with the earliest stages of stellar evolution, comprising the transition from a dark molecular cloud to a hydrostatic stellar object. The dynamical problems discussed here include gravitational instability, gravitational collapse and fragmentation, effects of rotation and magnetic fields, formation of a hydrostatic core, accretion processes and accretion shocks, effects of radiation on protostellar envelopes, mass loss and winds from young stellar objects, and possible rapid flareups and mass loss associated with the approach to radiative equilibrium in massive protostars. Most of these processes are far from being well understood and much theoretical work remains to be done, but it appears that existing theoretical results can explain qualitatively at least some of the principal observed properties of protostars and young stars. (29 refs) (auth)

8008 PERIOD AND AMPLITUDE CHANGES IN δ SCUTI STARS. Valtier, J. C.; Sareyan, J. P.; Le Contel, J. M.; Baglin, A. (Observatoire, Nice). Mem. Soc. R. Sci. Liege; 8: 223-226(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Long observational sequences have been performed on four δ Scuti stars at the ESO Observatory in Chile. Narrow band filters on the continuum have been used. The observed light curves are complex: periods and amplitudes vary even on a single night. It seems difficult to interpret these variations in terms of a mixture of different modes as it has been generally proposed up to now. It is proposed that non-linear effects taking place in the atmosphere should be responsible for these irregularities. It is stressed that in these objects the time scale of pulsation and convection are comparable and that the coupling between these two velocity fields should be taken into account. (auth)

8009 STABILITY OF NONLINEAR PERIODIC PULSATION OF STELLAR ENVELOPES. Van Sengbusch, K. (Max-Planck-Institut fuer Physik and Astrophysik, Munich). Mem. Soc. R. Sci. Liege; 8: 189-193(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The eigenvalue method to calculate models of periodically pulsating stars can be used to study the stability of the resulting oscillations. Results for a series of RR-Lyrae models are discussed. (6 figs) (auth)

8010 QUASIDYNAMIC METHOD FOR ROTATING STELLAR MODELS. Kovetz, A.; Lebovitz, N. R.; Shaviv, G. (Tel-Aviv Univ., Israel). Mem. Soc. R. Sci. Liege; 8: 25-30(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The equations of structure for a rotating star are modified by replacing the dynamic terms with certain quasidynamic terms that vanish when the configuration is in a steady state. The modified equations have the property that the steady-state solution is asymptotically stable if it is dynamically stable in the usual sense, and unstable if it is dynamically unstable in the usual sense. These equations are particularly suited for numerical integration, for the numerical scheme based on them converges if and only if the steady-state solution sought is dynamically stable. This incorporates in the numerical scheme a stability test that would otherwise have to be performed separately. (auth)

8011 DIFFERENTIAL ROTATION AND TURBULENCE IN STARS. Zahn, J. P. (Observatoire, Nice). Mem. Soc. R. Sci. Liege; 8: 31-34(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Due to the low viscosity of stellar interiors, shear instabilities are likely to be prominent in the radiative zones of differentially rotating stars. Because of the stabilizing effect of density stratification, the turbulent motions generated by those instabilities are mainly horizontal and they act to smooth out the differential rotation over level surfaces. A much stronger shear is tolerated in the vertical direction, between horizontal layers; the critical conditions for instability are estimated using a modified Richardson criterion. Finally, the interaction of this shear instability with the Eddington-Sweet circulation is briefly discussed. (auth)

8012 CONVECTION IN A ROTATING SPHERE. Weir, A. D. (Cambridge Univ., Eng.). Mem. Soc. R. Sci. Liege; 8: 37-42(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Numerical calculations of non-linear axisymmetric convection in a uniformly heated self-gravitating sphere of Boussinesq fluid indicate that the law of rotation in the convective core of a rotating star is more like one of uniform angular momentum per unit mass than of uniform rotation. (auth)

8013 TIME SCALES IN STELLAR SPIN-DOWN. Clark, A. Jr. (Univ. of Rochester, NY). Mem. Soc. R. Sci. Liege; 8: 43-46(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The distribution of angular momentum in the radiative core of a lower main sequence star will evolve in a manner determined by meridional circulations. Such circulations have two distinct sources: thermal driving throughout the core (Eddington-Sweet currents), and boundary driving associated with the stellar-wind torque on the outer convective envelope (spin-down). Spin-down under stellar conditions is a complex process involving a number of internal time scales. The present work gives a qualitative discussion of these time scales. An additional time scale is defined by the variation of the angular velocity of the convective envelope. Typically, this boundary time scale is longer than many of the internal time scales, a circumstance which allows simplifications in the basic equations. The most important internal time scale is the time required for a change in boundary velocity to penetrate the entire radiative core, and this turns out to be the Eddington-Sweet time. (auth)

8014 FISSION THEORY OF BINARY STARS FOR COMPRESSIBLE MASSES. Lebovitz, N. R. (Univ. of Chicago). Mem. Soc. R. Sci. Liege; 8: 47-53(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

A resumé is given of the classical fission theory of binary stars, emphasizing the fundamental assumptions and conjectures, and describing the resolutions of these conjectures that led to the abandonment of the theory. It is pointed out that the formulation of the theory was inconsistent, and that one of the principal conjectures was unnecessary. A reformulated version of the fission theory is described. In this version, which specifically allows for compressibility, thereby removing the inconsistency, an evolutionary picture similar to that of the classical theory emerges in a manner that may be free of the principal objections that have been raised against the latter. (auth)

8015 BUBBLE STABILITY OF DIFFERENTIAL ROTATIONS. Simon, R. (Univ., Liege). Mem. Soc. R. Sci. Liege; 8: 57-67 (1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The stability of stellar differential rotations is investigated by means of the approximate bubble method. Thermal conductivity is taken into account, but viscosity is neglected. The stability criterion obtained by this method is weaker than the Goldreich-Schubert-Fricke criterion, which results from the application of the approximate local method to the axisymmetrical oscillations of the star. The bubble stability criterion includes the Rayleigh inequality $2\Omega\,[2\Omega + \omega(\partial\Omega/\partial\omega)] > 0$ but not the severe condition $\partial\Omega/\partial z = 0$. (auth)

8016 EFFECTS OF MAGNETIC FIELDS: INTRODUCTORY REPORT. Mestel, L. (Univ. of Sussex, Eng.). Mem. Soc. R. Sci. Liege; 8: 79-91(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The two-way interaction between a star's thermal-gravitational field and its magnetic field is considered. Topics covered include: the stability of stellar magnetic fields, the distribution of magnetic flux through a star, the exterior of a magnetic star, and magnetic braking. (51 refs) (GHT)

8017 INSTABILITIES OF STARS CONTAINING MAGNETIC FIELDS. Markey, P.; Tayler, R. J. (Univ. of Sussex, Eng.). Mem. Soc. R. Sci. Liege; 8: 93-95(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Many possible magnetic field configurations inside stars can be shown to be unstable and the instabilities have growth times which are very short compared with either the thermal or the nuclear timescale of the star. It seems probable that most purely poloidal and purely toroidal fields are unstable and that the instabilities might lead to a substantial reduction of magnetic flux during a star's lifetime. The chance of a field structure being stable is very much greater when both poloidal and toroidal fields are present but it is not yet possible to state whether a wide range of such configurations is completely stable to short timescale disturbances. (auth)

8018 MERIDIONAL CIRCULATION IN MAGNETIC STARS. Moss, D. L. (Manchester Univ., Eng.). Mem. Soc. R. Sci. Liege; 8: 97-103(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Models of rotating magnetic stars with a steady state meridional circulation are found. A first order perturbation technique is used, and the velocity and magnetic fields are expanded in a series of Legendre polynomials truncated after the term in $P_4(\cos\theta)$, where θ is the co-latitude. The models seem to fall into two groups. In one the solutions are essentially small perturbations to solutions found previously with zero circulation. In the other group models are found with relatively weak magnetic fields in which, as the ratio of centrifugal to magnetic perturbation becomes large, the circulation deep in the star is the unimpeded Eddington-Sweet circulation, whilst near the surface the magnetic forces become important and the circulation velocity drops rapidly to zero. (auth)

8019 NEW RESULTS ON THE GENERATION OF MAGNETIC FIELDS BY DYNAMO ACTION. Raedler, K. H. (Zentralinstitut fuer Astrophysik, Potsdam, Ger.). Mem. Soc. R. Sci. Liege; 8: 109-116(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The paper deals with spherical dynamo models with both large and small scale motions showing some symmetries as to be expected in stellar objects. A survey is given on the types of magnetic fields which can be excited. Results for a special α-effect dynamo, the α^2-dynamo, are presented. In addition to axisymmetric stationary magnetic fields also non-axisymmetric oscillatory ones were found. The possibility is discussed of superposing different fields which leads to fields as occurring with the oblique rotator. (auth)

8020 PHOTOMETRIC VARIABILITY OF MAGNETIC STARS. Catalano, F. A. (Univ. of Catania, Italy). Mem. Soc. R. Sci. Liege; 8: 117-124(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The observational data on magnetic stars strongly suggest concentrations of the peculiar abundances in definite regions of the stellar surface. Under the hypotheses that: 1) the magnetic axis is inclined by an angle χ with respect to the rotational axis, which, in turn, is inclined of an angle i with respect to the line of sight; 2) the peculiar abundances are concentrated in regions around the magnetic poles; 3) the mechanisms producing the abundances do not depend on the polarity of the magnetic field; 4) the Chandrasekhar's limb darkening law is representative of the radiation field in the V light; the radiative flux emerging from the visible hemisphere of the star has been computed as a function of the angles i and χ and of the phase φ. A good agreement is found with the observations and the double wave in the V light curves is explained. (4 figs, 17 refs) (auth)

8021 STELLAR OSCILLATIONS, STELLAR STABILITY, AND APPLICATION TO VARIABLE STARS. Cox, J. P. (Univ. of Colorado, Boulder). Mem. Soc. R. Sci. Liege; 8: 129-159 (1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

A general review of current theories of stellar oscillations is presented, including linear, nonlinear, adiabatic, non-adiabatic, radial, and nonradial oscillations. Applications to various known types of intrinsic variable stars are discussed, and some outstanding problems in our current understanding of these stars are summarized. (3 figs, 157 refs) (auth)

8022 VIBRATIONAL STABILITY OF STARS IN THERMAL IMBALANCE. Demaret, J. (Univ., Liege). Mem. Soc. R. Sci. Liege; 8: 161-172(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The different methods used during the last years to study the effects of thermal imbalance on the vibrational stability of evolving stars are reviewed. In particular, if the problem is properly subdivided into "isentropic" and "non-isentropic" parts, application of an asymptotic method due to Feshchenko et al. (1967) enables one to solve the linearized pulsation partial differential equation up to the first order in Π/t_s, where Π is the adiabatic pulsation period for the fundamental mode and t_s, a "slow" time scale associated with the evolution. Some applications to simple analytic stellar models and to more realistic configurations are described. (28 refs) (auth)

8023 HERTZSPRUNG PROGRESSION IN CEPHEID CALCULATIONS. Christy, R. F. (California Inst. of Tech., Pasadena). Mem. Soc. R. Sci. Liege; 8: 173-181(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The Hertzsprung Bump in Cepheid models has been studied for models of a wide range of Mass, M, Radius, R, and Effective Temperature, T_e. This study showed that the delay of the Bump (in days) measured from the time of minimum radius preceding the Bump by one period is dependent only on M and R and not on T_e. Over a range of models from $M/M_\odot \approx .5$ and $R/R_\odot = 10$ to $M/M_\odot = 13$ and $R/R_\odot = 160$, the delay of the Bump (in days) is approximately proportional to the Radius. This is consistent with a picture that the Bump results from an acoustic signal that traverses the star from the ionization zone into the center and out again to the surface. The Bump and other nonlinear phenomena have been studied over a series of Cepheid models from a period of less than one day to a period of 150 days. The results show characteristic changes in amplitude and in the appearance of Bumps and are in good correspondence to actual Cepheids. The masses in this series are, however, characteristically lower than evolutionary masses. (8 figs, 1 table) (auth)

8024 EFFECT OF ROTATION IN STELLAR STRUCTURE AND EVOLUTION. Roxburgh, I. W. (Queen Mary Coll., London). Mem. Soc. R. Sci. Liege; 8: 15-24(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The development of our understanding of rotation in stellar structure and evolution is briefly reviewed. More recent work on rotation and convection, solar oblateness, the stability of differential rotation and the effect of rapid rotation on the solar neutrino flux is discussed. (auth)

8025 EFFECTS OF TITANIUM OXIDE UPON THE ATMOSPHERES OF LATE-TYPE STARS. Collins, J. G. Bloomington, IN; Indiana Univ. (1975). 159p. University Microfilms Order No. 75-23,423.

Thesis (Ph. D.).

An investigation of the role of the titanium oxide molecule (TiO) as a source of radiative opacity in the atmospheres of giant stars of spectral types K and M (effective temperature, T/sub eff/ less than or equal to 4000 K) has been conducted. The work examines the effects of this opacity upon the spectral energy distributions and temperature structures of these stars by means of a comparison of model atmospheres calculated with and without the TiO opacity. Computer programs were written to calculate the opacity arising from electric dipole transitions in diatomic molecules. For the purpose of elucidating the temperature-dependence and relative strengths of the TiO spectral features observed in stars, nearly complete spectral energy distributions were assembled from existing sources of spectrophotometry for the stars alpha Tau, (K III), mu Gem (M3III), alpha Her (M5Ib-II), and R Leo (M8e). Finally, a series of model atmospheres was prepared having effective temperatures ranging from 2500 K to 4000 K, surface gravity appropriate to giant stars (log g equals 2.0), solar elemental abundances, atomic line blanketing similar to that derived for the Sun, and the opacities due to Cn, Co, and H_2O which have been included in previous studies. As was long suspected from spectroscopic observations of K and M stars, the models show that the effect of the absorption features of the TiO band systems upon the emergent spectral energy distributions of these stars is appreciable and is very temperature sensitive. (Diss. Abstr. Int., B)

8026 POLARIZATION OF Be STARS. Johns, M. W. Hanover, NH; Dartmouth Coll. (1975). 145p. University Microfilms Order No. 75-23,369.

Thesis (Ph. D.).

Linear polarization of starlight may be produced by electron scattering in the extended atmospheres of early type stars. Techniques are investigated for the measurement and interpretation of this polarization. Polarimetric observations were made of twelve visual double star systems in which at least one member was a B type star as a means of separating the intrinsic stellar polarization from the polarization produced in the interstellar medium. Four of the double stars contained a Be star. Evidence for intrinsic polarization was found in five systems including two of the Be systems, one double star with a short period eclipsing binary, and two systems containing only normal early type stars for which emission lines have not been previously reported. The interpretation of these observations in terms of individual stellar polarizations and their wavelength dependence is discussed. The theoretical basis for the intrinsic polarization of early type stars is explored with a model for the disk-like extended atmospheres of Be stars. Details of a polarimeter for the measurement of the linear polarization of astronomical point sources are also presented with narrow band (DELTA lambda equals 100A) measurements of the polarization of gamma Cas from lambda 4000 to lambda 5800. (Diss. Abstr. Int., B)

8027 PULSAR MAGNETOSPHERES: THE ALIGNED ROTATOR. Morris, C. D. Jr. Houston, TX; Rice Univ. (1975). 164p. University Microfilms Order No. 75-22,045.

Thesis (Ph. D.).

The external magnetic field structure of a rapidly rotating magnetized star is studied. The interaction of the plasma with the magnetic field is included in the analysis. Several different models are considered, each being a step towards the final model. A detailed examination of the final model leads to the conclusion that the frozen-in-flux approximation must be violated in the non-asymptotic region. As a consequence, a completely charge-separated plasma is found to be an impossibility. An expression for the energy flux epsilon(f) is derived that depends upon the mass flux F(f) and the asymptotic particle velocity gamma, namely epsilon(f) equals $c^2F(f)gamma^3$. In the relativistic that applies to pulsars, this expression becomes independent of the mass loss, and the total energy loss rate and the torque on the star can be found for the case of the aligned magnetic field. Calculations for NP 0532 are shown to agree with the observed values. (Diss. Abstr. Int., B)

8028 DOUBLE STAR MASSES DETERMINED BY SYNCHRONOUS STELLAR AREA SCANNING. Atwood, B. Middletown, CT; Wesleyan Univ. (1975). 176p. University Microfilms Order No. 75-22,996.

Thesis (Ph. D.).

The study of double stars provides the only direct measurements of the masses of stars other than the sun. Stellar masses play a central role in stellar models. A novel method for processing the signal from stellar area scanning is presented. The stellar image is scanned rapidly enough to "freeze" gross motion due to seeing and telescope guiding error. Each of these rapid scans is processed in real time to determine its median. The scans are then stored such that the medians are superposed. The technique is called Synchronous Stellar Area Scanning. The resulting one dimensional intensity profiles are analyzed by doing a least-squares fit to a reference profile. While not providing the very high resolution information of Speckel Interferometry,

Synchronous Area Scanning does give a high signal to noise ratio on dim stars with much shorter observing times. Data are presented for 22 close visual pairs. A new mass determination for Ross 614 is presented. Measurements were made on 4 members of the Hyades, ADS 3264, 3483, 3135, and 3269. It is strongly indicated that the published orbit for ADS 3264 has a period considerably too long, and a new orbit should be calculated. Astrometric studies indicated that a companion for Bd + 6°398 should have been detectable (approximately 2.5 in., DELTA m/sub v/ approximately 4); no companion was seen, indicating a smaller separation and/or larger magnitude difference. No companion was observed for the astrometric binary Mu Cas. (Diss. Abstr. Int., B)

8029 STABILITY OF G^+ MODES IN A 30 $M_\odot$ STAR. Gabriel, M.; Noels, A.; Scuflaire, R.; Boruy, A. Mem. Soc. R. Sci. Liege; 8: 273-286(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The evolution of a population I 30 $M_\odot$ star during the main-sequence phases has been computed without semi-convective zone. Three models are tested for stability towards g^+ modes of non-radial oscillation. Whereas the Z.A.M.S. model is found stable, evolved models are unstable. The cause of the instability is interpreted to reside in the existence of superadiabatic temperature gradient in the region of varying chemical composition. (auth)

8030 AGE OF HB21 AND PSR 2021 + 51. Jones, E. M. (Los Alamos Scientific Lab., NM). Astron. Astrophys.; 42: No. 1, 147-150(Aug 1975).

The properties of the observed HI shell around supernova remnant HB 21 are used to derive an age between 0.26 and 0.79 million years. Ages in this range are inconsistent with properties of pulsar PSR 2021 + 51 which has been proposed as the neutron-star product of the HB 21 explosion. HB 21 may show marginal buoyant displacement. (auth)

8031 COMMENTS ON THE PULSATION OF DOUBLE MODE CEPHEIDS. King, D. S. (Univ. of New Mexico, Albuquerque); Hansen, C. J.; Ross, R. R.; Stellingwerf, R. F.; Cox, J. P. Mem. Soc. R. Sci. Liege; 8: 183-187(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The pulsation properties of stellar envelope models for stars with periods appropriate to the double mode Cepheids are investigated. Three different chemical compositions are used with X equals 0.70, Z equals 0.02; X equals 0.80, Z equals 0.02 and X equals 0.602, Z equals 0.044. Certain conclusions can be reached with regard to the masses and radii of these stars on the basis of the calculations. Results for both linear and nonlinear computations are presented. (1 fig, 3 tables, 13 refs.) (auth)

8032 HYDRODYNAMIC EFFECTS IN THE ATMOSPHERES OF VARIABLE STARS. Davis, C. G. Jr. (Los Alamos Scientific Lab., NM). Mem. Soc. R. Sci. Liege; 8: 197-207(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Numerical models of variable stars are established, using a non-linear radiative transfer coupled hydrodynamics code. The variable Eddington method of radiative transfer is used. Comparisons are for models of W Virginis, beta Doradus and eta Aquilae. From these models it appears that shocks are formed in the atmospheres of classical Cepheids as well as W Virginis stars. In classical Cepheids the bumps appearing in the light and velocity curves, for stars with periods from 7 to 10 days, appear as the result of a compression wave that reflects from the star's center in agreement with Christy. At the head of the outward going compression wave, shocks form in the atmosphere. Comparisons between the hydrodynamic motions in W Virginis and classical Cepheids are made. The strong shocks in W Virginis do not penetrate into the interior as do the compression waves formed in classical Cepheids. The shocks formed in W Virginis stars cause emission lines while in classical Cepheids, the shocks are weaker and their existence may possibly be evidenced in the recent Ultra-Violet (UV) data obtained via the O.A.O. satellite. (8 figs, 13 refs) (auth)

8033 NON-LINEAR RADIATION TRANSPORT CALCULATIONS TO OBTAIN MEAN COLORS AND TO VERIFY THE WESSELINK METHOD. Cox, A. N.; Davis, C. G. (Los Alamos Scientific Lab., NM). Mem. Soc. R. Sci. Liege; 8: 209-219(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Four Cepheid models of mass 4, 4, 7, and 15 solar masses, one of the 4 solar mass models representing Beta Doradus, have been numerically integrated. The variable Eddington radiation approximation has been used for the surface layers to produce structures accurate enough for spectrum predictions. Spectra are predicted at about 100 phases over three pulsational cycles. B and V colors are computed at these phases. Mean colors are taken by four different methods that could be applied to colors of an observed Cepheid. The mean color that gives the closest effective temperature to that for the non-pulsating model uses the intensity mean of B and V separately. In no case is the mean color too blue and the mean effective temperature excessively hot. Thus with an assumed accurate luminosity, none of the mean effective temperatures obtained from the different mean colors give radii too small. The Cepheid mass discrepancy, with pulsation masses involving the method of color mean, remains, and pulsation masses are still only 70 percent of those needed in evolutionary calculations. A discussion of the Wesselink method for pulsating star radius determinations shows that only small positive systematic errors can occur in the derived mean radii. 8 figs. (auth)

8034 EXTREMELY CARBON ENHANCED NOVA MODEL. Starrfield, S. G. (Arizona State Univ., Tucson); Sparks, W. M.; Truran, J. W. Mem. Soc. R. Sci. Liege; 8: 425-429(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

A thermonuclear runaway in a white dwarf envelope that consists of equal numbers of protons and ^{12}C nuclei has been studied. It was found that these initial conditions cause a "super" nova outburst that does not result in any s- or r-process nucleosynthesis. This model reaches peak temperatures of 1.6×10^9 °K and peak burning rates exceeding 2×10^{23} erg/gm/sec. A shock forms and ejects 10^{29} grams moving with speeds up to 60,000 km/sec. The peak bolometric magnitude is -21.2m and this model will also produce a gamma-ray burst. (GHT)

8035 CHEMICAL COMPOSITION OF THE SUN, JUPITER, METEORITES, AND Am STARS. Drobyshevskii, E. M. pp 143-152 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut Im. A. F. Ioffe (1974). (In Russian)

from conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

If surface anomalies in the composition of the metallic-line A stars (Am stars) are due to a precipitation on them of planet-like bodies (planetesimals), then one should expect correlation to exist between the overabundance of heavier-than-iron elements on these stars and their "standard" abundances in the Solar System (since chondrites provide the "standard" level for these elements). However, anticorrelation was revealed. Nevertheless, this fact supports the original suggestion on the origin of the metallicism of A stars and can be easily explained within the author's hypothesis on the formation of the Sun from the matter escaping from the proto-Jupiter (Nature, 250, 35, 1974). During the terminal stages of mass transfer, the matter was depleted strongly in nonvolatiles (forming the rocky core of Jupiter). Therefore the composition of the created meteorites should not coincide with the primary composition of the matter. Thus the outer Sun's layers can also have a distorted composition. It is concluded that the "standard" abundances of elements heavier than iron should be revised. (auth)

8036 MAGNETIC FIELD GENERATION AND CHARGED PARTICLE ACCELERATION IN BINARY STELLAR SYSTEMS. Dolginov, A. Z. pp 223-225 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

Two new possibilities of magnetic field generation in binary stellar systems are considered: The generation by tide forces. The velocities of the tide flow in the star are determined. If the star has the axes of rotation inclined to orbital plane the flow has complicated three-dimensional symmetry favorable for the field generation. Such flow may be very effective for the process of magnetic field generation. The inductive generation. Stars in the binary system move in the common magnetic field. This motion leads to the electrical current induction in the stellar bodies. The current creates the magnetic field in its turn. These processes may lead to the resulting magnetic field increasing. The necessary conditions and characteristic time scale for the increase of the field are determined. If the radius of the orbit is not large (being outside the Roche region) the time of the field generation is much shorter than the time of stellar evolution. The interstellar magnetic field configuration change itself because of stellar motion. Some closed outer configurations become open and the particles can escape from the acceleration region. The possibility of acceleration by "magnetic pumping" is shown. The binary systems may give the essential amount of low and middle energy cosmic ray intensity. (auth)

8037 POSSIBLE MECHANISM OF STELLAR FLARES. Vandakurov, Yu. V. pp 236-238 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Technicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

A hypothesis is put forward that some longitudinal motions whose kinetic energy is close to magnetic energy are formed inside the flux tube in order to ensure the thermal equilibrium. The mechanism exciting these longitudinal motions remains unclear as yet. Probably, in solving this problem, some small displacement of the whole flux tube with respect to the axis of star's rotation is of importance. In the present paper, however, only an idealized model of the axis-symmetric toroidal magnetic flux tube with a given longitudinal velocity distribution in the tube is considered. The problems of stabilizing and maintaining of such velocity field are discussed. It is suggested that some active phenomena (such as the solar flares) can occur mainly due to the excitation of an instability of the above velocity field (e.g. the tangential discontinuity instability) in the course of the flux tube eruption. However, it should be noted that mechanisms of nonthermal particle acceleration are not considered in the paper. (auth)

8038 PECULIAR A STARS: AN ADEQUATE SAMPLE FOR TESTING THE r-PROCESS. Kuchowicz, B. pp 297-310 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

Main characteristics of the so-called group of Ap stars are outlined; large overabundances of very heavy elements, especially from the Os-Pt peak and of the transbismuth region, with isotopic shifts of the wave-lengths (where measured) indicating generally a much larger contribution from r-processed matter than in solar system material; overabundances of the light rare earth elements which may be interpreted best in terms of fission-due contribution (arising either during, or after the r-process). (auth)

8039 POSSIBLE ANNIHILATIONAL ORIGIN OF GAMMA-RAY BURSTS AND STELLAR FLARES OF UV Cet-TYPE. Fomin, P. I. pp 385-392 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

An annihilational model of cosmic gamma-ray bursts and stellar flares of UV Cet-type is discussed in the framework of charge-symmetric model of the Galaxy with large-scale nonhomogeneity of the matter and antimatter distribution. The existence of high-energy gamma-ray bursts synchronous with low-energy ones is predicted. The model of the Galaxy used here is based on the "vacuum cosmological model" proposed by the author within the framework of which the known objections to the charge symmetry may be removed. (auth)

8040 γ-RADIATION FROM THE CENTRAL REGION OF THE GALAXY AND THE SEARCH FOR FLARE ACTIVITY AT THE ENERGY MORE THAN 100 MeV. Belyaevskii, A. I.; Bokov, V. L.; Bocharkin, V. K.; Gorodinskii, G. M.; Kruglov, E. M.; Myakinin, E. V.; Chuikin, E. I. pp 393-394 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

By means of gamma-telescope on satellite "Kosmos-561" the flux of γ-rays with energy more than 100 MeV from the central region of the Galaxy has been measured. The flux F is equal $F_\gamma(E_\gamma \geq 100\ \text{MeV}) = (8.3 \pm 2.7) \cdot 10^{-5}\ (\text{cm}^2\text{sec})^{-1}$. The method of high energy γ-ray flux measurements is discussed in detail. The upper limit of the flare activity for this energy range is established. (auth)

8041 POSSIBILITY OF DETERMINATION OF DIRECTION OF COSMIC-RAY BURST USING THE MEASUREMENT OF ITS INTENSITY. Kruglov, E. M.; Gorodinskii, G. M.; Bokov, V. L. pp 395-403 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The possibility has been investigated of the determination of direction cosmic gamma-ray burst using the measurement of its intensity by several detectors mounted in three perpendicular directions on board the single satellite. The errors of measurement of direction caused by the counting statistics and other factors have been calculated. It has been shown that the accuracy of determination of direction is about 1^0 in case of total counts 10^3. (auth)

8042 INFRARED OBSERVATIONS OF THE ASSOCIATION CYG OB 2. Voelcker, K. (Max-Planck-Inst. fuer Astronomie und Landessternwarte, Heidelberg). Astron. Astrophys., Suppl. Ser.; 22: No. 1, 1-7(Oct 1975).

All infrared photometric material for 103 stars in the association Cyg OB 2 is presented. (auth)

8043 PHOTOELECTRIC PHOTOMETRY OF LATE-TYPE VARIABLE STARS. Celis, S., L. Astron. Astrophys., Suppl. Ser.; 22: No. 1, 9-17(Oct 1975).

Presented are 168 photoelectric (UBV) observations of 30 late-type variable stars of long period which were made systematically during 8 observing runs from 1972 December to 1973 September. The B−V and U−B color indices obtained near maximum and minimum in V are plotted in the two-color diagram. (auth)

8044 ECLIPSING BINARY SYSTEM VV ORIONIS. Duerbeck, H. W. (Univ. Sternwarte, Bonn). Astron. Astrophys., Suppl. Ser.; 22: No. 1, 19-47(Oct 1975).

Simultaneous UBV, Hβ and spectroscopic observations yield absolute dimensions and orbital elements of the primary and secondary components of the detached eclipsing binary VV Ori (B1V + B7(?) V, P = 1.485 days). The rotation of the primary is found to be synchronous with the orbital motion. Old and new radial velocity measurements lead to improved orbital elements for the third invisible component. Some atmospheric parameters are derived from the equivalent widths of the hydrogen lines. Changes in the equivalent widths and disturbances in the light curves indicate the existence of a gaseous stream with a particle density of about $10^{11}\ \text{cm}^{-3}$. (auth)

8045 PRELIMINARY RESULTS OF AN ANALYSIS OF INTERSTELLAR ABSORPTION LINES IN THE UV SPECTRA OF THE STARS β Cru, μ Sco, δ Ori, σ Ori, HD 63922, AND γ Ara. Grewing, M. (Univ., Bonn); Wulf-Mathies, C.; Walmsley, C. M. Mitt. Astron. Ges.; No. 35, 183-185(1974). (In German)

The UV spectra of the stars, which cover the spectral wavelengths ranges from 2060 to 2160 A, from 2495 A, and from 2775 to 2875 A with a resolution of 1.8 A, were analyzed to determine the equivalent widths of interstellar absorption lines. The significance of the results of the analysis are discussed. The results of the investigation appear to show that Mg and Fe relatively to H are less abundant than in the case of solar values. (IAA)

8046 GAS STREAM IN THE SYSTEM 68u HERCULIS. Kowatschew, B. J. (Academy of Science, Sofia). Mitt. Astron. Ges.; No. 35, 189-193(1974). (In German)

Results of spectroscopic observations of the eclipsing binary 68u Herculis (B3 III) are given. Diagrams are given which show the variation of equivalent widths with phase for lines of the Balmer series. A method is proposed which allows to detect gas streams in spectroscopic binaries of early spectral type. It is necessary to take a small number of spectrograms symmetrically to the primary minimum or to the secondary minimum. If a gas stream is present, the equivalent width of the Balmer lines is stronger after the minimum than before the minimum. This effect is more pronounced at the secondary minimum. (auth)

8047 LUMINOSITY FUNCTION AND MASS DENSITY OF STARS NEAR THE SUN. Jahreiss, H.; Wielen, R. (Univ., Heidelberg). Mitt. Astron. Ges.; No. 35, 212-213(1974). (In German)

A study was conducted of new information presented in the Catalogue of Nearby Stars, edition 1969, compiled by Gliese. The number of stellar systems which are closer than 20 pc has increased by 15% during the period from 1957, when the first Gliese catalog was published, to 1969. Characteristics of the luminosity function are discussed, giving attention to the luminosity function determinations conducted by a number of authors. A calculation of mass density in the vicinity of the sun takes into account a mass-luminosity relation which was improved on the basis of the latest mass determinations of weak double stars. (IAA)

8048 NEUTRON STAR MODELS: A TEST OF THEORIES OF GRAVITATION. Hillebrandt, W. (Technische Hochschule,

Darmstadt, Ger.); Heintzmann, H. Mitt. Astron. Ges.: No. 35, 244-247(1974).

Attention is given to the possible existence of conditions in the Jordan-Brans-Dicke theory which place an upper limit on the mass of a neutron star and restrict the redshift of photons which are emitted from the star's surface. Corresponding conditions exist in Einstein's theory of gravitation. It is found in the analysis that neutron stars do not provide a powerful tool for testing relativistic theories of gravitation. (IAA)

8049 OBSERVED PROPERTIES OF 147 PULSARS. Taylor, J. H.; Manchester, R. N. (Univ. of Massachusetts, Amherst). Astron. J.; 80: No. 10, 794-806(Oct 1975).

The principal parameters of all known pulsars have been compiled and listed in tabular form, together with references to the sources of information. A number of quantities derived from the observations are also tabulated, including distance, height above the galactic plane, spectral index, radio luminosity, rate of kinetic energy loss, characteristic age, and surface magnetic field. (auth)

8050 BINARY STELLAR WINDS. Siscoe, G. L.; Heinemann, M. A. (Massachusetts Inst. of Tech., Cambridge). pp 243-255 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Stellar winds from a binary star pair will interact with each other along a contact discontinuity. We discuss qualitatively the geometry of the flow and field resulting from this interaction in the simplest case where the stars and winds are identical. We consider the shape of the critical surface (defined as the surface where the flow speed is equal to the sound speed) as a function of stellar separation and the role of shock waves in the flow field. The effect of stellar spin and magnetic sectors on the field configuration is given. The relative roles of mass loss and magnetic torque in the evolution of orbital parameters is discussed. (IAA)

8051 STELLAR WINDS. Roberts, P. H. (Newcastle-upon-Tyne Univ., Eng.). pp 231-242 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

An attempt is made to provide a motivation for the study of stellar winds. The theory of steady, spherically-symmetric, coronal expansion according to both the one-fluid and the two-fluid continuum pictures is reviewed. Some similarities between, and differences from, the problem of spherical expansion in classical gas dynamics are noted. (auth)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 7963, 7973, 7974, 7977, 7978, 7990, 7991, 8155, 8176, and 8211.

8052 (N-75-12862) WHAT IS SPECIAL ABOUT CYGNUS X-1. Boldt, E. A.; Holt, S. S.; Rothschild, R. E.; Serlemitsos, P. J. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Nov 1974. 61p. (NASA-TM-X-70791; X-661-74-3). NTIS $4.25.

The X-ray evidence from several experiments is reviewed, with special emphasis on those characteristics which appear to distinguish Cygnus X-1 from other X-ray emitting objects. Data are examined within the context of a model in which millisecond bursts are superposed upon shot-noise fluctuations arising from events of durations on the order of a second. Possible spectral-temporal correlations are investigated which provide additional evidence that Cygnus X-1 is very likely a black hole. (auth)

8053 (N-75-13700) SUPERLIGHT EXPANSION OF COMPACT RADIO SOURCES IN QUASARS. Kurilchik, V. N. Translated from Priroda; No. 8, 42-47(1974). 28p. (NASA-TT-F-16009). NTIS $3.25.

The expansion is discussed of the radio variable structures of the quasars 3C 273 and 3C 279 at speeds from 4 to 10 C. The hyperlight speeds of quasi-sources, and the hyperlight expansion of real sources are analyzed, and a theoretical model of radio variability is described. (STAR)

8054 ABSORPTION ANOMALIES IN COMPACT X-RAY SOURCES. Garmire, G. P. (California Inst. of Tech., Pasadena); Ryter, C. E. Astrophys. Lett.; 16: No. 3, 121-123(1975).

It is suggested that apparently deficient interstellar X-ray absorption on the line of sight to compact X-ray sources must be due to a soft X-ray emission excess. Suitable multiple emission regions are predicted to exist in accretion discs (Thorne and Price, 1975). Examples of this feature are found in Cyg X-1 and Sco X-1. (auth)

8055 SOURCE COUNT ANALYSIS FOR A HOMOGENEOUS SAMPLE OF FAINT RADIO QUASARS. Fanti, C.; Fanti, R.; Ficarra, A.; Formiggini, L.; Giovannini, G.; Padrielli, L. (CNR, Bologna). Astron. Astrophys.; 42: No. 3, 365-377(Sep 1975).

In this paper the statistical properties of a sample of faint radio quasars are examined, and a comparison is made with the stronger quasar samples from the 3 CR and 4 C catalogues. A significant correlation is found between the radio spectral index distribution and the apparent magnitude. A second, but less significant, correlation is also found between the spectral index distribution and the ratio R between radio and optical flux. The flux and magnitude distribution of the present sample is analyzed within the framework of current cosmological and evolutionary ideas, and the distribution of quasars, as a function of the parameter R, in the unit comoving volume, is derived. It is found that: the quasar counts are explained for a wide range of values of R by a unique evolution law similar to the one already found for 3 CR and 4 C samples; quasars at low R, a large fraction of which may have prominent compact flat spectrum components, evolve significantly lower in number density with increasing z; locally ($z \ll 1.0$) a large fraction of all quasars (30% to 100%) are radio emitters with $\log R > 2.0$; at higher redshifts the bulk of quasars tend to have lower radio luminosity ($\log R < 2.5$) or to become radio quiet; and locally the radio luminosity of quasars matches that of radio nuclei of elliptical galaxies, suggesting some continuity between the nuclear phenomena in ellipticals and the quasar phenomena. (auth)

8056 DISTANCES OF THE QUASARS AND EVIDENCE FOR NONVELOCITY REDSHIFTS. Arp, H. (Hale Observatories, Pasadena, CA). pp 443-450 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

Observational evidence for nonvelocity redshifts is reviewed. Statistical evidence is presented to show how all quasars may have originated from galaxies of much lower redshift, and the four closest cases of quasars associated with galaxies are discussed (2020-37 with a small spiral galaxy, 3C 455 with NGC 7413, Mark 205 with NGC 4319, and PHL 1226 with IC 1746). Evidence for high-redshift, compact, and peculiar companion galaxies (including Stephan's Quintet) is outlined, and theoretical explanations of intrinsic redshifts are noted (gravitational redshift, the difference between proper and coordinate time at large spacetime distances, photon-photon scattering, and creation of low-mass matter). It is concluded that all the present evidence favors the physical association of at least some quasars with nearby galaxies. (IAA)

8057 THEORIES OF QUASARS. Woltjer, L. (Columbia Univ., New York). pp 429-440 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

Theoretical interpretations of quasar redshifts are reviewed, and quasar models are described. Gravitational, kinematic, and cosmological redshift origins are described, and evidence is presented which supports a cosmological origin. Potential doubts are discussed in regard to the redshifts of all quasars being cosmological, including the spatial associations of objects of very different redshifts and the observed expansion of radio sources. Current proposals for sources of quasar energy are reviewed, and two very possible models are described: a large number of pulsars accelerating particles which then radiate in the low-frequency wavefields of the pulsars and a massive rotating object, possibly a black hole configuration which accretes matter. (IAA)

8058 OBSERVATIONAL RESULTS ON COMPACT GALACTIC X-RAY SOURCES. Giacconi, R. (Smithsonian Astrophysical Observatory, Cambridge, MA) pp 27-72 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

Observational results are discussed concerning the strongest galactic binary X-ray sources. Developments in X-ray astronomy are reviewed, and the following binary sources are treated in detail: Her X-1, Cen X-3, Cyg X-1, and Cyg X-3. Substantial observational data are presented for each source, and it is shown that Her X-1 and Cen X-3 are probably accreting, rotating neutron stars, the Cyg X-1 system contains a black hole, and

Cyg X-3 is still unidentified. Other established X-ray binaries are discussed on the basis of their day-to-day and short-term (time scale of 1 sec or less) variabilities. (IAA)

8059 OPTICAL PROPERTIES OF BINARY X-RAY SOURCES. Bahcall, J. N. (Inst. for Advanced Study, Princeton, NJ); Bahcall, N. A. pp 73-96 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

The optical counterparts of six X-ray sources known to be in binary systems are discussed (HZ Her/Her X-1, ?/Cen X-3, HD 153919/3U 1700-37, HD 77581/Vela XR-1, Sk 160/SMC X-1, and HDE 226868/Cyg X-1). Detailed summaries of data for each system are presented and include X-ray and optical properties, establishment of optical identifications, and mass estimates. Significant facts noted include the unusual spectral type, optical luminosity and variations, and position of HZ Her; the difficulty in determining the counterpart of Cen X-3; and the substantial evidence that Cyg X-1 is a black hole. Attempts to locate an optical counterpart to Cyg X-3 are described, and uncertainties in determining the masses of X-ray sources with and without regular pulsations are noted. (IAA)

8060 PHYSICS OF BINARY X-RAY SOURCES. Rees, M. J. (Cambridge Univ., Eng.). pp 97-117 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

The general physical nature of binary X-ray systems is described on the basis of a model in which the X-ray source is regarded as being associated with either a neutron star or a black hole. Conditions necessary for the existence of an accretion disk are outlined, and possible radiation mechanisms are proposed for Schwarzschild and Kerr black holes and a spinning, magnetized neutron star. Situations are noted where the Eddington limit can be violated. Specific physical phenomena are described which may be inferred from observations of Her X-1, Cen X-3, Cyg X-1, Sco X-1, and Cyg X-3. The optical light curves and radio properties of X-ray binaries are briefly discussed. (IAA)

8061 RADIO OBSERVATION OF SMALL GALACTIC NEBULAE. Kazes, I.; Le Sequeren, A. M.; Gadea, F. (Observatoire de Paris, Meudon, France). Astron. Astrophys.; 42: No. 1, 9-16(Aug 1975).

Out of 97 sharpless small nebulae 45 have been detected at 1416 and 4850 MHz; they mostly show flat spectral indices. Optical position and diameters have been measured and data for the radio counterparts are presented. In some cases radio and optical excitation parameters are compared and their apparent differences are discussed. (auth)

8062 RADIO SOURCE AND CLUSTER OF GALAXIES IN 3 U 1252-28. Vidal, N. V. (Mount Stromlo and Siding Spring Observatory, Canberra, Australia). Astron. Astrophys.; 42: No. 1, 145-146(Aug 1975).

The optical identification of 3 U 1252-28 with a cluster of galaxies is discussed. (auth)

8063 HYDRODYNAMICS OF ACCRETION DISCS I: STABILITY. Stewart, J. M. (Max-Planck-Institut fuer Physik und Astrophysik, Munich). Astron. Astrophys.; 42: No. 1, 95-101(Aug 1975).

The disc is idealized to be a stationary axisymmetric toroidal flow of a compressible fluid. The stability against linearized short wavelength perturbations is discussed. When the Rayleigh and Schwarzschild criteria are satisfied the flow is stable against axisymmetric perturbations. However almost all non-axisymmetric perturbations are not secularly stable, and examples of dynamically unstable modes are given. (auth)

8064 NEUTRAL HYDROGEN ABSORPTION SPECTRA. Lazareff, B. (Observatoire de Paris, Meudon, France). Astron. Astrophys.; 42: No. 1, 25-35(Aug 1975).

Observations of 21 cm line absorption spectra at intermediate latitudes were made with the Nancay radiotelescope with an effort towards improved sensitivity. The absorption spectra are combined with emission brightness temperature spectra to discuss the spin temperature and other properties of interstellar neutral hydrogen. A correlation is found between the optical depth and the spin temperature of the clouds. The velocity dispersion of the clouds is found to be larger in emission than in absorption. The nature of the diffuse component seen only in emission is discussed. The results are compared with existing models of the interstellar medium, and the observed $\tau - T_s$ correlation seems to favor equilibrium models. (auth)

8065 EFFECTS OF TURBULENT VELOCITIES ON MASER LINES. Gail, H. P.; Kegel, W. H.; Sedlmayr, E. (Univ., Heidelberg). Astron. Astrophys.; 42: No. 1, 81-84(Aug 1975).

The theory of line formation in turbulent media (Gail et al., 1974) is applied to the case of an unsaturated maser. It is shown that the emitted maser line depends strongly on the correlation length l of the turbulent velocity field. Both the total intensity and the line width increase with increasing l. The influence of the finite correlation length has the opposite sign and is much stronger than in the case of a positive absorption coefficient. (auth)

8066 LIGHT CURVE OF HZ HERCULIS. Livio, M.; Shaviv, G. (Tel Aviv Univ., Israel). Astron. Astrophys.; 42: No. 1, 17-23(Aug 1975).

The effect of a low density corona around HZ Her, on the observed light curve is calculated. The agreement with observation, for several assumed density profiles in the corona, is not good. A better agreement is obtained when a cloud of matter around Her X-1 is assumed. The results support the hypothesis of a "third light" in the system HZ Her-Her X-1. (auth)

8067 RECENT OBSERVATIONS OF QUASI-STELLAR OBJECTS. Burbidge, E. M. (Univ. of California, La Jolla). pp 451-462 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

Some observational results are discussed which have a bearing on the problem of QSO redshifts. A general description of QSO absorption-line spectra is presented, and the spectra of four objects are reviewed. The hypothesis is advanced that production of absorption lines at many different redshifts is due to line-locking. Two QSOs with redshifts greater than 3 are described, and questions raised by the discovery of a double QSO with two different redshifts are discussed. Efforts to determine associations between QSOs and galaxies are outlined, and some questions are posed concerning physical models, effects of strong gravitational fields, and different types of QSOs. (IAA)

8068 FORMATION OF X-RAY BINARIES. De Loore, C.; De Greve, J. P. (Astrophysical Inst., Brussels). Mem. Soc. R. Sci. Liege; 8: 399-405(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

It is assumed that massive x-ray binaries such as Cen X-3, 2U 1700-37, Cyg X-1, SMC X-1, Vela X-1, with periods between 2 and 9 days, are evolution products of initial binary systems where mass loss from a massive primary occured after hydrogen exhaustion in the core, followed by a supernova explosion. Computations are performed for a binary system with a 20 $M_\odot$ primary, accompanied by secondaries of 14, 10, 8, 6 and 4 $M_\odot$. It is argued that some of these initial systems might evolve towards final models that satisfy the observed mass ratios and periods for the mentioned x-rays binaries. (2 figures, 2 tables, 12 references) (auth)

8069 DISTRIBUTION OF QUASARS IN THE UNIVERSE. Schmidt, M. (Hale Observatories, Pasadena, CA). pp 463-471 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

Derivation of the distribution of quasars in space from well defined quasar samples is discussed. It is shown that a luminosity function may be found which represents the number of quasars of specific optical and radio luminosities at a specific redshift per unit comoving volume of space. The statistics of optical quasars and their redshifts are discussed, and the problems of uniform distribution and density law are reviewed. From the available data, it is concluded that quasars cannot have a uniform distribution in space and that much more observational work is needed for further elucidation of quasar statistics. (IAA)

8070 X- AND γ-RAY DISCRETE SOURCES. Gnedin, Yu. N. pp 341-342 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

The observational data and some theoretical models concerning the x-ray binary systems are briefly considered. The same observational data and theoretical consideration concerning the origin of the cosmic γ-ray bursts are also discussed. (auth)

8071 SOME PROPERTIES OF X-RAY BINARIES. Bahcall, J. N. pp 343-354 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

Three questions pertaining to x-ray binaries are discussed: the origin of the observed periodicities; the estimated masses of the unobserved secondaries; and the nature of the secondaries. (auth)

8072 LONG-TERM ON-OFF VARIATION AND THE 35D CYCLE OF THE BINARY SYSTEM HZ HER-HER X-1. Boerner, G.; Meyer, F.; Schmidt, H. U.; Thomas, H. C. (Max-Planck Inst. fuer Physik and Astrophysik, Munich). Mitt. Astron. Ges.; No. 35, 220-221(1974). (In German).

Solar Phenomena

Refer also to abstracts 7941-7944, 8024, 8035, 8210, 8215, 8218, 8220, 8233, 8246, 8249, 8252, 8253, 8262, 8263, and 8280.

8073 (N--75-12871) LUNAR PARTICLE SHADOWS AND BOUNDARY LAYER EXPERIMENT: PLASMA AND ENERGETIC PARTICLES ON THE APOLLO 15 AND 16 SUBSATELLITES. Final Report. Anderson, K.A.; Chase, L. M.; Lin, R.P.; McCoy, J.E.; McGuire, R.E. (California Univ., Berkeley (USA). Space Sciences Lab.). 28 Jun 1974. 103p. (NASA-CR-140371). NTIS $5.25.

The lunar particle shadows and boundary layer experiments aboard the Apollo 15 and 16 subsatellites and scientific reduction and analysis of the data to date are discussed with emphasis on four major topics: solar particles; interplanetary particle phenomena; lunar interactions; and topology and dynamics of the magnetosphere at lunar orbit. The studies of solar and interplanetary particles concentrated on the low energy region which was essentially unexplored, and the studies of lunar interaction pointed up the transition from single particle to plasma characteristics. The analysis concentrated on the electron angular distributions as highly sensitive indicators of localized magnetization of the lunar surface. Magnetosphere experiments provided the first electric field measurements in the distant magnetotail, as well as comprehensive low energy particle measurements at lunar distance. (auth)

8074 (N-75-12874) MICROSCALE ALFVEN WAVES IN THE SOLAR WIND AT 1 AU. Burlaga, L. F.; Turner, J. M. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Nov 1974. 20p. (NASA-TM-X-70793; X-692-74-329). NTIS $3.25.

Analysis of IMP 1 (Explorer 43) plasma and magnetic field fluctuations on a scale of one hour revealed that linearly and circularly polarized Alfven waves are rarely present in the solar wind at 1 AU. The most prevalent microscale fluctuations appeared to be large-amplitude Alfven waves with small but nonzero fluctuations in the magnetic field intensity. These waves are present about 40 percent of the time and are predominantly propagating away from the sun. (auth)

8075 (N-75-12882) RELATIONSHIP BETWEEN SOLAR FLARES AND SOLAR SECTOR BOUNDARIES. Dittmer, P. H. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Oct 1974. Contract N00014-67-A-0112-0068. 11p. (NASA-CR-140856; SU-IPR-597). NTIS $3.25.

A superimposed epoch analysis of 1964-1970 solar flares shows a marked increase in flare occurrence within a day of (-+) solar sector boundaries, as well as a local minimum in flare occurrence near (+-) sector boundaries. This preference for (-+) boundaries is more noticeable for Northern Hemisphere flares, where these polarities match the Hale polarity law, but is not reversed in the south. Plage regions do not show such a preference. (auth)

8076 (N-75-12884) DIRECTIONAL DISCONTINUITIES FROM MARINER 5 AND SOLAR WIND STRUCTURE. Turner, J. M. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Aug 1974. 36p. (NASA-TM-X-70733; X-693-74-234). NTIS $3.75.

Directional discontinuities from Mariner 5 are studied. A substantial majority of the events have properties which are consistent with their being identified as tangential discontinuties. The results presented here agree in several respects with those of Burlaga from Pioneer 6. In addition, new results are presented. Previous Mariner 5 work on this subject is summarized with an explanation of apparent inconsistencies. (auth)

8077 (N-75-14585) COMPTON-GETTING EFFECT FOR LOW ENERGY PARTICLES. Ipavich, F. M. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Jun 1974. Contract NAS5-11063. 16p. (NASA-CR-139164). NTIS $3.25.

It was found that the traditional first-order Compton-Getting effect, which relates particle distributions as observed in two frames of reference moving with constant relative velocity, is inadequate for the description of low energy particles (less than a few hundred keV/nucleon) in the solar system. An exact procedure is given for recovering both isotropic and anisotropic distributions in the solar wind frame from observations made in a spacecraft frame. The method was illustrated by analyzing a particle event observed on IPM-7. (auth)

8078 (N-75-17276) MARINER VENUS/MERCURY 1973 SOLAR RADIATION FORCE AND TORQUES. Georgevic, R. M. (Jet Propulsion Lab., Pasadena, Calif. (USA)). 1 Dec 1974. Contract NAS7-100. 162p. (NASA-CR-142092). NTIS $6.25.

The need for an improvement of the mathematical model of the solar radiation force and torques for the Mariner Venus/Mercury spacecraft arises from the fact that this spacecraft will be steering toward the inner planets (Venus and Mercury), where, due to the proximity of the Sun, the effect of the solar radiation pressure is much larger than it was on the antecedent Mariner spacecraft, steering in the opposite direction. Therefore, although the model yielded excellent results in the case of the Mariner 9 Mars Orbiter, additional effects of negligible magnitudes for the previous missions of the Mariner spacecraft should now be included in the model. This study examines all such effects and incorporates them into the already existing model, as well as using the improved model for calculation of the solar radiation force and torques acting on the Mariner Venus/Mercury spacecraft. (auth)

8079 (N-75-20190) ANALYSIS OF OSO DATA TO DETERMINE THE STRUCTURE AND ENERGY BALANCE OF THE SOLAR CHROMOSPHERE. Avrett, E. H.; Kalkofen, W. (Smithsonian Astrophysical Observatory, Cambridge, Mass. (USA)). Feb 1975. 26p. (NASA-CR-142262; SAO-503-060). NTIS $3.75.

A detailed reexamination of the temperature-density structure of the photosphere and low chromosphere shows that the middle and upper chromosphere, which directly emits most of the OSO spectrum, is sensitive to conditions in this underlying region of the atmosphere. A model of this region is based on a unified compilation of all recently published broadband flux and central intensity observations of the solar spectrum from 500 microns in the far infrared to 1220 A in the far ultraviolet. This extensive compilation includes the OSO 4 and 6 observations in the wavelength range 1400 to 1220 A. A model is presented of the quiet solar atmosphere in the height range between the temperature minimum and the upper part of the chromosphere-corona transition region. This model is based on statistical equilibrium calculations of H, He 1, He 2, Si 1, C 1, and other ions. (auth) (STAR)

8080 STUDY OF SFA ON 164 kHz FOR TASHKENT-DELHI PROPAGATION. Sengupta, P. R. (Inst. of Applied Manpower Research, New Delhi). pp 114-143 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

A detailed study of flare effects on 164-kHz field-strength for Tashkent-Delhi propagation has revealed that the observed change in signal due to flare belongs to one of the following three types: type I events, characterized by a rapid increase in the signal followed by an approximately exponential decay, are found to be due to type I and the softer of type II flares classified by Sengupta (1971 and 1974); type II events are correlated with Sengupta's type II flares and are characterized by an initial dip in the signal followed by a rapid increase and an approximately exponential decay after the maximum; type III events are due to Sengupta's type III and the harder of type II flares and are characterized by rapid decrease in the signal followed by slow recovery. Theoretical calculations are made to show that this behavior can be explained fully in terms of lowering of the D-layer height and change in the electron density gradient at the bottom of the D-layer. (auth)

8081 INTERPRETATION OF THE VLF OBSERVATIONS OF THE SOLAR FLARE OF 7th AUGUST 1972. Ananthakrishnan, S.; Abdu, M. A.; Sahai, Y. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil). pp 145-153 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

Pronounced phase and amplitude changes were observed on the 17.8 kHz very low frequency (VLF) transmissions from NAA, Cutler, Maine (USA) received at São José dos Campos during the solar flare of 7th August 1972. The amplitude changes were abnormal in the sense that, whereas in all flare effects recorded on NAA only amplitude increases were observed, in the 7th August event, the amplitude showed a large absorption effect. The observations are interpreted using full wave methods. The electron density profiles derived have been used to calculate the expected values of phase and amplitude changes at other frequencies on which flare effects were observed. The values predicted by the model and those observed are compared and discussed. (auth)

8082 POSSIBILITY OF PHOTOSPHERIC ORIGIN OF SOLAR FLARES. Uchida, Y. (Univ., Tokyo). Astrophys. Lett.; 16: No. 3, 101-106(1975).

Attention is directed to the possibility that the tiny brightenings observed at the start of a flare in the low chromosphere or the upper photosphere could be the source of an active flare. (auth)

8083 SOLAR NEUTRINOS AND VARIATIONS IN THE SOLAR LUMINOSITY. Ulrich, R. K. (Univ. of California, Los Angeles). Science; 190: No. 4215, 619-624(14 Nov 1975).

Recent study of solar models suggests that the solar luminosity could vary on a time scale shorter than the age of the earth. Two possible processes that could cause luminosity variations, the diffusion of heavy elements into the center of the sun and a pulsational instability caused by the distribution of ^{3}He, are discussed. None of the explanations for the lack of detectable neutrinos are satisfactory. (33 references) (BJG)

8084 FIRST RESULTS OF THE SOVIET–POLISH SPACE EXPERIMENT INTERCOSMOS-KOPERNIK 500. Hanasz, J. (Inst. of Astronomy, Torun, Poland); Aksenov, V. I.; Komrakov, G. P. pp 67-73 of Exploration of the Planetary System. Woszczyk, A. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on exploration of the planetary system; Torun, Poland (5 Sep 1973).

The report contains a short description of the first Soviet–Polish space experiment, which has been accomplished aboard the "Intercosmos-Kopernik 500" satellite. The purpose of the experiment is to observe sporadic radio emissions generated in the coronal and interplanetary medium at hectometric wavelength range and to measure parameters of the ionospheric plasma by means of the low- and high-frequency impedance probes. The idea of the experiments is presented together with the brief description of the measuring equipment and data recorded. First results of the space observations are shown. The correlation between electron density of the ambient plasma, ion-sheath capacitance of the aerial, and the upper hybrid frequency can be seen. (IAA)

8085 MODE DECAY AND EVOLUTION OF THE SOLAR WIND ALFVEN WAVE SPECTRUM. Cohen, R. H. (Princeton Univ., NJ). J. Geophys. Res.; 80: No. 25, 3678-3680(1 Sep 1975).

The treatment of Alfven wave mode decay by Cohen and Dewar (1974) is extended to a regime of finite temperature and large acoustic wave damping rates for a model (Lorentzian) Alfven wave power spectrum. When applied to hydromagnetic waves in the solar wind, the theory predicts a degradation of the low-frequency (approximately(1 day)$^{-1}$) portion of the spectrum on a time scale of the order of the time required for such waves to travel several AU. (auth)

8086 NONADIABATIC NONRADIAL OSCILLATIONS. Christensen-Dalsgaard, J.; Gough, D. O. (Cambridge Univ., Eng.). Mem. Soc. R. Sci. Liege; 8: 309-316(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The stability of a solar model on the main sequence to linearized nonadiabatic nonradial oscillations has been studied. In the inner 99.9% by radius the eigenfunctions were barely distinguishable from those of the adiabatic approximation. The integrated effect of this region is to stabilize the oscillations at zero age, but after a time of order 10^8 yr the destabilizing effect of the ^{3}He (^{3}He, 2p) ^{4}He reactions exceeds the damping. However there is much more severe damping in a nonadiabatic shell beneath the photosphere about 300 km thick, which dominates the entire effect from the rest of the star interior to this shell. (4 figures, 12 references) (auth)

8087 VIBRATIONAL STABILITY OF G^+ MODES TOWARDS NONRADIAL OSCILLATIONS FOR SOLAR MODELS. Noels, A.; Gabriel, M.; Boury, A.; Scuflaire, R.; Ledoux, P. (Univ., Liege). Mem. Soc. R. Sci. Liege; 8: 317-323(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The vibrational stability of solar models towards g^+ modes has been studied from the ZAMS up to the age of 5 billion yr. The nuclear energy contribution to instability is calculated with the effective sensitivity of the reactions to change of temperature. The perturbation of convective terms is taken from an extension for non-radial oscillations of Unno's theory. The ZAMS model and the present sun are stable. However, for intermediate ages, models are unstable with respect to the lowest modes due to the effects of nuclear reactions. If, moreover, the mechanical effects are taken into account, all models are unstable. However their theory is uncertain enough to require caution. (3 figures, 2 tables) (auth)

8088 SOLAR BERYLLIUM ABUNDANCE. Chmielewski, Y. (Observatoire, Geneva); Mueller, E. A.; Brault, J. W. Astron. Astrophys.; 42: No. 1, 37-46(Aug 1975).

An interpretation of high resolution center-limb observations of the Be II resonance lines in the solar spectrum is given. It is shown that to account for the observed spectrum it is necessary to allow for (1) a source of additional opacity in the UV continuum which we derived empirically for the HSRA and the revised Holweger model and (2) departures from LTE in the Be I–Be II system. It is found that the $2p^3P^0$ metastable level of Be I is significantly underpopulated and that beryllium is more ionized than expected in LTE. The kinetic equilibrium calculations yield a beryllium abundance of $\log\epsilon_{Be} = 1.15 \pm 0.20$ (on the basis of $\log\epsilon_H = 12.00$) which is in agreement with previous determinations based on the LTE assumption. (auth)

8089 CHARACTERISTIC PAIRS OF TYPE III BURSTS AS THE ELECTROMAGNETIC RESPONSE TO A DISPERSIVE STREAM EXCITER. Daigne, G. (Observatoire de Meudon, Paris). Astron. Astrophys.; 42: No. 1, 71-79(Aug 1975).

The concept of characteristic pairs of Type III bursts, or "f–h pairs" previously described for the metric range, is extended to other observations in various frequency ranges. It is argued that the two components of a burst pair are radiated in the same mode and from a common source. A review of the properties of Type III bursts favors the second harmonic radiation mode at all frequencies. Satellite observations of Type III and electron bursts confirm that the exciter is a dispersive electron stream. Under the new hypothesis the two components of a "harmonic" pair are both radiated at the second harmonic of the plasma frequency; the corresponding plasma waves are excited by electrons of the same stream but of different speeds. The measured time delays between the first and second components at 38 and 76 MHz yield electron speeds of about 0.3 c and 0.2 c respectively. The evolution of the time delay between the two components is consistent with a free-streaming electron bunch. The apparent relative source positions and relative directivities within burst pairs can be explained if considering two different emission diagrams: the emission diagram of the first component would be narrower than the emission diagram of the second component, in the forward direction. It is suggested that the first component is a brightness increase on the leading front of some Type III bursts; and that it is produced by a redistribution of plasma waves (due to induced scattering into the non-resonant part of the spectrum) occurring at a critical stage of the plasma-stream interaction. (auth)

8090 SOLAR MAGNETO-ATMOSPHERIC WAVES WITH A HORIZONTAL MAGNETIC FIELD. Nye, A. H. Rochester, NY; Univ. of Rochester (1975). 118p. University Microfilms Order No. 75-22,766.

Thesis (Ph. D.).

The theory of magneto-atmospheric waves (involving the combined restoring forces due to buoyancy, compressibility, and magnetic field) is developed for the case of a horizontal magnetic field. This theory is applied to certain observed wave phenomena in the solar atmosphere, namely the running penumbral waves and the flare-induced coronal waves. The stability of the undisturbed atmosphere in the presence of a vertically varying horizontal field is discussed. A general propagation equation is obtained for adiabatic perturbations with arbitrary vertical distributions of the sound speed c, Alfven velocity v/sub A/, and local density scale height H. Recently waves propagating horizontally outward across sunspot penumbrae have been observed in H alpha. A model is developed here that reproduces all of the relevant features of vertical penumbral structure. A simple two-layer penumbral model is studied, for which the eigenmodes are computed analytically. The results of both penumbral models show that the trapping of waves in the penumbral photosphere is not sensitive to the values of atmospheric parameters, and that the running penumbral waves should be observable in photospheric spectral lines. (Diss. Abstr. Int., B)

8091 SPECTRAL ANALYSIS OF SOLAR SPICULES. Krall, K. R. Laramie, WY; Univ. of Wyoming (1975). 154p. University Microfilms Order No. 75-22,332.

Thesis (Ph. D.).

The spectral characteristics of solar limb spicules are investigated, using high dispersion emission spectra obtained through an observational program conducted by others at the Sacramento Peak Observatory. The tower telescope and echelle spectrograph were used to obtain time sequences of simultaneous spectra in various wavelength regions using an entrance slit tangent to the solar disc. Through photometric reduction, total intensities, spicule diameters, Doppler velocities, and profile halfwidths are measured. Using intensity ratios and line widths, temperatures and electron densities are estimated (T/sub e/ less than $25{,}000^0$K, 3×10^{10} cm^{-3} less than n/sub e/ less than 3×10^{11} cm^{-3}). Large scale spicule expansions are ruled out, although possible expulsions or accretions of material are observed. Small differences in real diameters in various emission lines are a possibility. Corrections of the observations for atmospheric turbulence and variations in spectrograph slit heights are made. Halfwidths and Doppler shifts are found to vary in time similarly in H alpha and ionized calcium emission lines. Inclinations of spectral emission lines are probably caused in varying degrees by velocity variations parallel and perpendicular to spicule axes, and by superposition of profiles of separate or multi-component structures. (Diss. Abstr. Int., B)

8092 INITIAL RESULTS FROM THE EUV SPECTROHELIOMETER ON ATM. Reeves, E. M.; Timothy, J. G.; Foukal, P. V.; Huber, M. C. E.; Noyes, R. W.; Schmahl, E. J.; Vernazza, J. E.; Withbroe, G. L. AIAA Paper 74-1258. New York; American Institute of Aeronautics and Astronautics (1974). 61p.

From conference on scientific experiments of Skylab; Huntsville, AL, USA (30 Oct 1974).

The Harvard College Observatory photoelectric spectroheliometer on the Apollo Telescope Mount operated correctly in orbit from May 29, 1973 to Feb. 7, 1974. During this period many thousands of spatial and spectral scans at extreme ultraviolet wavelengths were recorded during observations of a variety of solar features. The construction and modes of operation of the instrument are outlined and the principal scientific results from a preliminary analysis of the data are described. (auth)

8093 DEVELOPMENT OF A COMPUTER CODE FOR THE CALCULATION OF STELLAR EVOLUTION, WITH APPLICATIONS TO SOLAR MODELS OF LOW NEUTRINO FLUX. Newman, M. J. Houston, TX; Rice Univ. (1975). 165p. University Microfilms Order No. 75-22,050.

Thesis (Ph. D.).

A general purpose computer code has been developed to allow the detailed calculation of evolutionary sequences of hydrostatic stellar models under many circumstances of astrophysical interest. Solution of the structure equations is by the relaxation technique throughout the star without explicit integration and fitting for the outer envelope. A new matrix method of algebraic solution of the finite difference equations is employed, together with a modification of that method for the treatment of the central boundary condition. The method is easily adapted to an integration technique for the construction of initial models. It is demonstrated how the matrix technique allows determination of the derivatives of the matching condition in a single integration. The modification of the code for the purpose of detailed evolutionary calculation of a portion of a star is presented through the modification of the boundary conditions to represent in simple fashion the remainder of the star. Stability and convergence problems encountered in earlier versions of the code are discussed, as well as the techniques used to overcome them. The structure of the code is highly modular, so as to easily accommodate changes in input physics. Following the ad hoc suggestion of Clayton (1974), the calculations were repeated with the high energy tail of the Maxwell distribution of relative ion velocities depleted by various amounts. As an example of the technique of evolving a portion of a star a second application to the solar neutrino problem is made. (Diss. Abstr. Int., B)

8094 SOLAR WIND THREE: PROCEEDINGS OF THE THIRD CONFERENCE, PACIFIC GROVE, CALIFORNIA, MARCH 25-29, 1974. Russell, C. T. (ed.). Los Angeles; University of California (1974). 494p. $10.00.

Papers are presented relating to the study of solar abundances, the evolution of the solar wind, solar corona dynamics, solar wind interactions, and stellar winds. Some of the topics covered include the nuclear composition of cosmic rays, the solar wind as deduced from lunar samples, spectral characteristics of flares, numerical simulation of interplanetary shock ensembles, radial gradient of solar wind velocity from 1 to 5 AU, the enhancement of solar wind fluctuations with scale size near the proton gyroradius, solar wind-Venus interaction observed from magnetic field experiment on Mariner 10, and binary stellar winds. (IAA)

8095 SOME PROBLEMS OF NUCLEAR ASTROPHYSICS OF THE SUN. Kocharov, G. E. pp 17-20 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

The following items are considered: solar neutrons and γ-quanta; isotopes of hydrogen and helium in solar particle fluxes of flare origin; energy of optical emission in the flares. It is shown that the measured great amount of helium-3 nuclei in some solar flares, data on solar neutrons and γ-quanta and the energy of optical emission in the flares may be explained satisfactorily assuming the existence in solar substance of helium-3 with abundance greater than those in solar wind. In conclusion the problems are listed which are of primary consideration: What is the energy spectrum of solar cosmic rays [SCR] in the region of their generation and what is the difference between it and the spectrum measured in space? What is the region of SCR generation? What is their angular distribution? Is there any preferable acceleration of some elements and isotopes? What are the energy and time-spectra of primary SCR particles and products of nuclear reactions n,d,t, He-3 etc.? What is the character of motion of primary and secondary particles in solar substance and the particular mechanisms of generation of electromagnetic radiation? What are the excitation functions and the kinematics of nuclear reactions producing isotopes of hydrogen and helium-3? These problems need new theoretical and experimental investigations. The general approach is clearly seen—it is necessary to try to obtain data simultaneously on energy spectrum (especially in low-energy region) and time-dependence of the intensity of primary and secondary solar particles and γ-quanta. (auth)

8096 SOME NEW PROBLEMS OF SOLAR PHYSICS BASED ON STRATOSPHERIC INVESTIGATIONS. Krat, V. A. pp 21-24 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

New data on solar physics have been obtained during two flights of the solar stratospheric observatory in 1970 and 1973. The telescope of the observatory is of Cassegrainian system with main mirror 1 m in diameter. The absence of deuterium in solar atmosphere is established. The solar granulation is of two-component character. The dimensions of granules and their movement pointed at the predominance of wave movements in granulation. The continuous character of changes in solar photosphere resulting in solar flares is established. The flares are not the local formations. The structure of sun spots pointed at the presence of homogeneous magnetic beams of the large scale disintegrating in thin ones at the periphery of the spot. The movements in the solar atmosphere confirm the dominating role of wave movements and raise a question of the deep structure of the active regions. (auth)

8097 γ RAY LINES FROM SOLAR FLARES. Ramaty, R.; Lingenfelter, R. E. pp 25-57 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

The theory of γ-ray line production in solar flares is examined. The strongest line, both predicted theoretically and detected observationally at 2.2 MeV, is due to neutron capture by protons in the photosphere. The neutrons are produced in nuclear reactions of flare accelerated particles which also produce positrons and prompt nuclear γ rays. From the comparison of the observed and calculated intensities of the lines at 4.4 or 6.1 MeV to that of the 2.2 MeV line it is possible to deduce the spectrum of accelerated nuclei in the flare region; and from the absolute intensities of these lines it is possible to obtain the total number of accelerated nuclei at the Sun. The study of the 2.2 MeV line also gives information on the amount of He^3 in the photosphere. The study of the line at 0.51 MeV resulting from positron annihilation complements the data obtained from the other lines; in addition it gives information on the temperature and density in the annihilation region and on the anisotropy of the accelerated electron beam which produces continuum γ rays at energies greater than about 1 MeV. (auth)

8098 SOLAR ^{3}He: INFORMATION FROM NUCLEAR REACTIONS IN FLARES. Ramaty, R.; Kozlovsky, B. pp 58-84 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

Nuclear reactions can give information on solar ^{3}He in two ways: An upper limit on the photospheric ^{3}He can be set by considering the neutrons produced by nuclear reactions in flares. These neutrons propagate down into the photosphere where they can be captured by protons to produce 2.2 MeV γ rays. But if the photospheric ^{3}He/H ratio is about 5×10^{-5}, only about half the neutrons are captured by protons; the remaining neutrons interact with ^{3}He and produce no γ rays. The comparison of the 2.2 MeV line with other nuclear lines which are unaffected by ^{3}He yields a photospheric ^{3}He abundance, which, for the presently available γ-ray observations, is consistent with the ^{3}He abundance in the solar wind. Energetic ^{3}He nuclei in solar particle events have occasionally abundances which greatly exceed the above values or upper limits. We argue that these abundances can be explained by nuclear reactions of flare accelerated particles with the ambient solar atmosphere. However, in order to account for the great variablity in the observational data, several assumptions must be made regarding the directionality of the interactions and the acceleration of the nuclei after their production. (auth)

8099 γ-RADIATION BURSTS OBSERVED DURING AUGUST 4 AND 7, 1972 FLARES AT SATELLITE PROGNOS-2. Vedren, Zh.; Likin, O. V.; Melioranskii, A. S.; Pisarenko, N. F.; Savenko, I. A.; Talon, R.; Shamolin, V. M. pp 85-86 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

The device for study of x- and γ-radiation of the Sun placed on satellite "Prognos-2" resgistered the x-ray bursts related to the August 4 and August 7, 1972 flares. The observed γ-radiation appears on the Sun at the nuclear reactions of the accelerated protons with the substance of the solar atmosphere. The behavior in time of the burst and radio-emission of type II is in good correlation. The analysis shows that the appearance of the protons in the flare as well as the shock waves happens at the same stage of the event. The results obtained permit to suppose that the flare event includes 4 stages: the initial period, the period of acceleration of electrons, explosion period, or the period of acceleration of energetic protons and electrons, the hot period. (auth)

8100 NEUTRONS OF THE SOLAR ORIGIN. Dubinskii, Yu.; Efimov, Yu. E.; Kudela, K. pp 89-90 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad, Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

Questions about solar neutrons are considered. The necessity of further solar neutrons investigations are pointed out and some consideration about these investigations are given. (auth)

8101 SOME REMARKS ON SOLAR NEUTRINOS. Bachall, J. N. pp 131-133 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

It is argued that progress on the solar neutrino problem requires additional experiments and that there are many different experiments that would provide fundamental new insights. (auth)

8102 FAST NONSTATIONARY PROCESSES INTO SOLAR INTERIOR AND SOLAR NEUTRINO. Starbunov, Yu. N. pp 134-140 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad, Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

To bring the theory and solar neutrino experiments into agreement 2 new hypotheses about possible ways of neutron generation into solar interior is put forward and considered. It is noted that the only nucleus suitable for continuous neutron generation is ^{49}Tl. The possible chain is discussed for this nucleus. In case of periodic processes the similar nucleus can be ^{13}C. (auth)

8103 PLASMA IONS VELOCITY DISTRIBUTION AND SOLAR NEUTRINOS. Vasil'ev, S. S.; Kocharov, G. E.; Levkovskii, A. A. pp 141-142 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

To explain the substantial decrease of predicted values of solar neutrino fluxes, the absence of high energy ions with amount of one per cent of total number of solar plasma particles is suggested. Assuming high value of ^{3}He abundances under the convective zone it is possible to explain both secular increasing of ^{3}He/^{4}He and anomalous great value of ^{3}He/^{4}He in particle fluxes from some solar flares. (auth)

8104 COSMIC RAY INTENSITY VARIATIONS AND THE SOLAR WIND. Vernov, S. N.; Tverskoi, B. A.; Lyubimov, G. P.; Pereslegina, N. V.; Kontor, N. N.; Chuchkov, E. A. pp 159-162 of Uskorenie Chastits I Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851.

The hypothesis of the active regions as the source of quasi-stationary plasma fluxes is developed using the study of the cosmic ray intensity variations and their comparison with parameters of active regions on the Sun and the velocity and density of the interplanetary magnetized plasma. The dominating role of the minimal plasma velocity to form the front of the flux is shown. The diagrams of directionality of plasma fluxes in meridional plane to equator direction in different periods of solar activity are measured. The correlation between parameters of the active regions, average velocity of the flux and amplitude cosmic ray intensity variations is found. The interpretation of 11 year cycle change of solar wind flux is given. The reducing of flux velocity in the solar wind is discovered and the radial gradient of the velocity is measured. The correlation between the velocity of the flux and the power of the active region is found. (auth)

8105 OBSERVATIONS OF HELIOGEOPHYSICAL EVENTS IN JULY 1974. Avdyushin, S. I.; Zevakina, R. A.; Nazarova, M. N.; Pereyaslova, N. K.; Petrenko, I. E.; Stepanyan, N. N. pp 211-220 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The results of experimental observations of heliogeophysical events occurring 2 to 10 July 1974 are presented. At that time high solar activity unusual for this period approaching solar minimum was observed. At the same period in space there were recorded protons with energy more than 5 MeV. On July 5 maximum flux about 10^5 protons $cm^{-2}sec^{-1}$ was recorded. Maximum proton energy did not exceed 100 MeV. On July 4 and 6 in the Earth's high latitude magnetosphere according to the detector with threshold energy $E_p > 90$ MeV Forbush decreases of Galactic cosmic rays were observed. The most pronounced effect about 18% (from neutron monitor near the Earth about 10%) was recorded on July 6. Simultaneously with the beginning of Forbush decrease on July 4 magnetic storm commenced during which five SC were observed. Those events evidently were connected with shock waves resulting from solar flares on July 3 and 4. Solar activity of similar nature was observed in August 1972. However in July 1974 high solar activity did not create radiation danger in space; this fact may be explained by the structure of solar magnetic field and the state of interplanetary cosmic space. (auth)

8106 ACCELERATION OF PARTICLES IN THE PROCESSES OF SOLAR FLARE TYPE. Syrovatskii, S. I. pp 226-228 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The process of formation and disrupture of the neutral current sheet is considered for the vicinity of the magnetic zero line in a plasma. The conditions when the disrupture of the neutral sheet accompanied by particles acceleration up to high energy is discussed. A comparison of the two models is given: neutral sheet and Petchek's flow. The sintetic model is possible in which the overall picture corresponds to the neutral sheet development, but for the processes inside the neutral sheet Petchek's flow may have place on the quasistationary phase of sheet development. However, the sheet rupture and particle acceleration occurs at the next sharply non-stationary phase. (auth)

8107 ELECTRIC AND MAGNETIC FIELDS APPEARING AT THE BREAK OF A NEUTRAL CURRENT SHEET. Somov, B. V.; Syrovatskii, S. I. pp 229-230 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

In connection with the problem of the particle acceleration, the electric and magnetic fields which appear during the break of a neutral current sheet are determined. The neutral sheet is considered infinitely thin and ideally conductive. It is shown that in the region of sheet breaking a singular neutral line of a magnetic field appears (a magnetic neutral line with electric field directed along this line). (auth)

8108 SHOCK WAVE WITH LIGHT EMISSION AND A BURST PHASE OF SOLAR FLARES. Rumyantsev, A. A. pp 233-235 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The magnetohydrodynamic shock wave propagation with light emission in the solar chromosphere is considered. Isothermal shock waves transmit practically all the subphotospheric energy into upper layers. The transient zone width at the front of the wave is evaluated. The charged particle acceleration processes at the front region are also considered. The acceleration and leakage processes are most significant in the solar filaments. (auth)

8109 ROLE OF NUCLEAR REACTIONS IN EVOLUTION OF THE SOLAR SYSTEM MATTER. Lavrukhina, A. K. pp 251-254 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

For studies of the effect of nuclear reactions by high energy particles the most precise data were used for cosmic isotopic abundances and regularities of dependences of $\beta_{Ai} = f(E_p, A_t, A_{pr})$, obtained in numerous experiments on proton accelerators. The quantitative calculations showed that the most intense irradiation of the proto-solar matter by high energy particles took place $\sim 11 \times 10^9$ years ago, apparently, during the united galactic nucleosynthesis. It resulted in production of Li, Be, B, ^{40}K atoms and the most light stable isotopes with atomic masses from 50 to 200. (auth)

8110 PROPAGATION OF SOLAR ELECTRONS WITH ENERGIES $E_e > 30$ keV IN INTERPLANETARY SPACE. Kurt, V. G.; Logachev, Yu. I.; Pisarenko, N. F. Cosmic Res. (USSR) (Engl. Transl.); 13: No. 2, 196-207(1975).

Translated from Kosm. Issled.; 13: No. 2, 222-235(1975).

An analysis of data on the observation of electrons of solar origin with energies $E_e > 30$ keV conducted using an instrument mounted on satellites of the Prognoz series is presented in the report. A model of the propagation of such electrons is proposed on the basis of this study. Following the instantaneous injection, the electrons of a solar flare propagate in a compact cluster within a narrow cone with an opening of $\lesssim 10°$, exciting along their way bursts of type III radio radiation. A small fraction of the particles of the cluster represent the diffusion component usually observed 60-100 min after the injection. The model examined explains the results obtained earlier on the observation of particles moving along field lines "without dispersion," as well as the "cones of propagation" introduced phenomenologically. Moreover, since a majority of flares in which electrons are generated are usually low in importance, the predominant observation of electrons from flares on the western hemisphere of the sun becomes understandable. (auth)

8111 SOLAR WIND THREE. Proceedings of the Third Conference, Pacific Grove, California, March 25-29, 1974. Russell, C. T. (ed.). Los Angeles; University of California (1974). 494p. $10.00.

Papers are presented relating to the study of solar abundances, the evolution of the solar wind, solar corona dynamics, solar wind interactions, and stellar winds. Some of the topics covered include the nuclear composition of cosmic rays, the solar wind as deduced from lunar samples, spectral characteristics of flares, numerical simulation of interplanetary shock ensembles, radial gradient of solar wind velocity from 1 to 5 AU, the enhancement of solar wind fluctuations with scale size near the proton gyroradius, solar wind-Venus interaction observed from magnetic field experiment on Mariner 10, and binary stellar winds. (IAA)

8112 PHOTOSPHERIC FACULAE 1966-1970. Szymanski, W. Acta Geophys. Pol.; 23: No. 1, 106-109(1975).

Observations of photospheric faculae carried out from 1966 to 1970 are reported. (BJG)

8113 NUCLEAR COMPOSITION OF SOLAR COSMIC RAYS. Hovestadt, D. (Max-Planck-Institut for Physics and Astrophysics, Munich). pp 2-25 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Experimental observations of the elemental and isotopic composition of solar flare particles are discussed. Sources and characteristics of particle-emitting solar flare events are reviewed, and techniques for separating particle species are briefly described. Data are presented for the elemental composition of the solar atmosphere, and the possibility of determining the solar helium abundance from solar cosmic-ray observations is explored. The main experimental determinations of heavy element abundances at energies greater and less than 10 MeV/nucleon are summarized, and techniques for measuring the ionic charge composition of solar cosmic rays are outlined. Models explaining heavy element enhancements are described along with processes leading to gamma-ray emission during solar flare events. Observations of the rare isotopes of hydrogen and helium during solar flare events are noted, and a lower atmospheric limit is derived for nuclear reactions leading to positron decay. The possibility of investigating low-energy solar cosmic rays by measuring the relative abundances of different elements is evaluated. (IAA)

8114 INTERACTION OF A COMET WITH THE SOLAR WIND. Biermann, L. (Max-Planck-Institut for Physics and Astrophysics, Munich). pp 396-414 for Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Observational evidence and theoretical work are reviewed in regard to the transfer of momentum from the solar wind to cometary ions and the ionization of molecules in the outer parts of cometary heads by charge transfer. The direction and structure of cometary tails and the properties of streamers around plasma tails are described. Mathematical work done on plasma flow around a comet is outlined, and it is shown that the overall size of the region in which the flow pattern is noticeably modified by the presence of a comet is comparable with the size of a region pervaded by an equivalent quantity of solar wind. Theoretical models of the charge transfer process are described, but it is suggested that they be verified by Lyman-alpha observations of future comets. The development of the concept of a solar wind is outlined, and the role of comets as probes of the solar wind is noted. (IAA)

8115 RELATIONSHIP BETWEEN VELOCITY GRADIENTS AND MAGNETIC TURBULENCE IN THE SOLAR WIND. Garrett, H. B. (Rice Univ., Houston, TX). pp 390-394 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

The correlations among the time derivative of the solar-wind velocity, the magnitude of the interplanetary magnetic field (IMF), and the IMF turbulence level are examined to test the idea that interaction between two colliding solar-wind streams can generate turbulence in the solar wind and the IMF. Data obtained by Explorer 33 on the solar wind and IMF are described, and the analysis techniques are outlined. The results indicate that the IMF turbulence level, as measured by the variance, is correlated with the existence of positive velocity gradients in the solar wind. It is noted that while the variance is an increasing function of the field magnitude, it is also independently correlated with the solar-wind velocity gradient. (IAA)

8116 PRELIMINARY RESULTS ON COMET KOHOUTEK. Brandt, J. C.; Maran, S. P. (Goddard Space Flight Center, Greenbelt, MD). pp 415-420 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

A preliminary summary is presented for the types of data obtained on possible interactions between Comet Kohoutek and the solar wind. The data include Pioneer 8 solar wind density measurements along a line of sight through or near the comet's position; Pioneer 6 plasma measurements near the projected position of the ion tail 100 million km from the nucleus; Lyman-alpha observations of the cometary hydrogen cloud from Skylab and Mariner 10; and ground-based radio, spectroscopic, and photographic observations. Preliminary analysis of some data is provided. (IAA)

8117 SOLAR WIND INTERACTION WITH VENUS: REVIEW. Wallis, M. K. (Oxford Univ., Eng.). pp 421-427 of Solar Wind

Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Three models of the solar wind-Venus interaction are evaluated: the strong magnetic field, pseudomagnetosphere model is discounted because Mariner 5 data showed a weakening of the magnetic field near the planet; the weak convection field model is shown not to correlate with experimental data; and the plasma absorption model is shown to have some qualitative advantages for ionospheric theory, but is quantitatively dependent on the structure and extent of the outer exosphere. Ionizing flows resulting from the interaction of upper atmospheric processes and the solar wind plasma are described analytically, and equations for the flow and distribution functions of the suprathermal exospheric component are derived. The shock Mach number is shown to be an important index in ionizing flows, and it is suggested that future space probes should aim at determining this number together with the velocity distributions of ions and energetic neutrals in the outer exosphere. (IAA)

8118 RADIAL GRADIENT OF SOLAR WIND VELOCITY FROM 1 TO 5 AU. Collard, H. R.; Wolfe, J. H. (Ames Research Center, Moffett Field, CA). pp 281-290 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Solar wind velocity measurements made by Pioneers 10 and 11 are compared to investigate radial variations in the velocity at heliocentric distances of 1 to 5 AU. Two hundred days of corresponding Pioneer 10 and 11 data are plotted, the velocity profiles for 25-day segments are compared, and the same general pattern of peaks and troughs is found in the corresponding profiles. A comparison of the relative smoothness of the profiles clearly shows that velocity amplitudes in the solar wind stream structure decrease dramatically with increasing radial distance from the sun, although the rate of decrease is not as clear. It is hypothesized that stream-stream interactions play a dominant part in inhibiting the classical radial expansion process in the solar wind and produce scattering centers which prevent the observation of a significant galactic cosmic ray gradient in this region of space. (IAA)

8119 EFFECT OF COSMIC RAYS ON THE DISTANT SOLAR WIND. Jokipii, J. R. (Univ. of Arizona, Tucson); Lee, L. C. pp 224-229 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

A new effect of cosmic rays on wave propagation in the solar wind which gives rise to a class of perpendicular hydromagnetic waves whose phase velocity can be much larger than the usual magnetosonic mode is discussed. At distances greater than about 30 AU, the solar wind is effectively subsonic with respect to these modes. The possible effect of these waves on a terminal shock transition of the solar wind is discussed. (auth)

8120 INTERPLANETARY HEAT CONDUCTION: IMP 7 RESULTS. Feldman, W. C.; Montgomery, M. D.; Asbridge, J. R.; Bame, S. J.; Lewis, H. R. (Los Alamos Scientific Lab., NM). pp 334-342 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Heat flux conducted by coronal electrons is the dominant energy source which drives the solar wind. Both collisional and collisionless treatments of the solar-wind expansion problem predict the development of instabilities which are expected to lead to enhanced level of waves resulting in a reduction in plasma thermal conductivity. Experimental evidence consistent with the notion that the interplanetary heat flux is "locally" regulated by microinstabilities at 1 AU is reviewed. Briefly, the electron dimensionless third velocity moment is statistically independent of electron temperature and the electron heat flux appears to be nearly the same before and after abrupt connection to the earth's bow shock through the magnetic field. Furthermore, solar-wind electron-velocity distributions at 1 AU are observed to be, on the average, marginally stable with respect to the growth of electromagnetic ion cyclotron and/or magnetosonic waves. (auth)

8121 EVIDENCE OF A VELOCITY GRADIENT IN THE SOLAR WIND. Smith, E. J.; Rhodes, E. J. Jr. (California Inst. of Tech., Pasadena). pp 329-331 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Sector-boundary velocity data obtained by Mariner 5 near Venus and by Explorers 33, 34, and 35 near earth are analyzed to determine why higher velocities were measured at earth. Differences in the corresponding velocities are plotted as a function of the heliocentric latitude separation of Mariner and earth, and evidence of a significant latitude gradient in the solar wind is found. Several indirect arguments in support of a latitude gradient are presented, and it is concluded that if the solar wind velocity varies with latitude, latitudinal stresses may have a significant effect on the properties of the solar wind, such as the existence and character of the north-south component of the interplanetary magnetic field. (IAA)

8122 THEORETICAL PREDICTIONS OF LATITUDE DEPENDENCIES IN THE SOLAR WIND. Winge, C. R. Jr.; Coleman, P. J. Jr. (Univ. of California, Los Angeles). pp 319-320 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Results are presented which were obtained with the Winge-Coleman model for theoretical predictions of latitudinal dependencies in the solar wind. A first-order expansion is described which allows analysis of first-order latitudinal variations in the coronal boundary conditions and results in a second-order partial differential equation for the perturbation stream function. Latitudinal dependencies are analytically separated out in the form of Legendre polynomials and their derivative, and are reduced to the solution of radial differential equations. This analysis is shown to supply an estimate of how large the coronal variation in latitude must be to produce an 11 km/sec/deg gradient in the radial velocity of the solar wind, assuming steady-state processes. (IAA)

8123 THREE DIMENSIONAL MODELLING. Suess, S. (Space Environment Lab., Boulder, CO). pp 311-317 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Three-dimensional modeling of the corona and the solar wind outside the corona is analyzed. Exact solution and source surface models of coronal expansion are described, and the criteria for an acceptable model of the high-speed stream structure are outlined. Theoretical considerations for axisymmetric models of the solar wind are discussed analytically, including radial flow, magnetic pressure imbalance, meridional flow, and mass and radial magnetic fluxes in the solar equatorial plane. It is concluded that three-dimensional modeling is necessary for understanding theoretical limitations in studies confined to the equatorial plane and for gaining insight into processes occurring outside of this plane. (IAA)

8124 LATITUDE DEPENDENTS OF THE SOLAR WIND. Rosenberg, R. L.; Winge, C. R. (Univ. of California, Los Angeles). pp 300-310 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

The motion of spacecraft following the earth's orbit occurs within the solar latitude range of 7 deg 15 min N on approximately September 7 to 7 deg 15 min S on approximately March 6. The latitude dependencies so far detected within this range have shown that the photospheric dipole-like field of the sun makes very important contributions to the interplanetary magnetic field (IMF) observed near the ecliptic. Changes in geomagnetic activity from even to odd numbered 11-year solar cycles are related to changes in the sun's dipolar field. The north-south IMF component and meridional, nonradial flow are important to a complete understanding of steady-state solar wind dynamics. Coronal conditions must be latitude-dependent in a way that accounts for the observed latitude dependence of the velocity and density of the solar wind. (auth)

8125 RADIAL GRADIENT AND THE ROLE OF TURBULENCE IN THE SOLAR SYSTEM. Intriligator, D. S. (Univ. of Southern California, Los Angeles). pp 294-299 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Pioneer 10 observations from the Ames Research Center Plasma Analyzer experiment between 1 and 3 AU have been used to estimate the power spectra of the solar wind proton streaming speed. The power spectra indicate that significant turbulence on the scale of 1,000,000 km or more is present throughout this range of heliocentric distances, implying the importance of the role of large scale turbulence between 1 and 3 AU. (auth)

8126 POWER ASSOCIATED WITH DENSITY FLUCTUATIONS AND VELOCITY FLUCTUATIONS IN THE SOLAR WIND. Intriligator, D. S. (Univ. of Southern California, Los Angeles). pp 368-372 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Direct observations from Pioneer 6 of solar-wind-proton fluctuations have been used to obtain the power spectra associated with solar-wind-proton number density and velocity fluctuations in the frequency range of 0.001 to 0.01 Hz, extending previous analyses by an order of magnitude at the higher frequencies. The slopes of the power spectra associated with the density fluctuations and the velocity fluctuations are similar and are in agreement with the shape of the power spectra found at the lower frequencies. The power spectra indicate that the power-law density spectrum observed at lower frequencies extends to at least 0.01 Hz. This smooth variation in the spectrum at these frequencies is consistent with previous extrapolations of both spacecraft and interplanetary scintillation observations. (auth)

8127 INTERPLANETARY SCINTILLATIONS. Coles, W. A.; Rickett, B. J.; Rumsey, V. H. (Univ. of California, La Jolla). pp 351-367 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Macroscopic and microscopic features of interplanetary radio scintillations are described on the basis of 3- and 4-site observations. Data are presented which indicate that the assumption of a radially directed solar wind effectively frozen over time scales of less than 2 seconds is well justified, the average solar wind speed varies with solar latitude, and corotating streams and other transient features are clearly delineated by velocity and scintillation index enhancements. The 3-dimensional electron density spectrum is found to be represented by a power-law dependence on wave number, and a very close fit to observed scintillation indices at 10 to 180 deg from the sun is obtained for a simple power-law turbulence model. It is concluded that most radio sources either are broader in angular extent at 74 MHz than previously thought, or contain significant nonscintillating components. (IAA)

8128 CORONAL TRANSIENT PHENOMENA. Wu, S. T.; Han, S. M. (Univ. of Alabama, Huntsville). pp 144-146 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

A hydrodynamical description of outward propagating disturbances from the sun's surface in a model solar atmosphere is considered. Use is made of this model to explain the coronal transient phenomenon. It was found that this radial flow model clearly indicates the mass flow as being continuous, going out from the surface of the sun. Detailed results are presented for the disturbed density, velocity and temperature of the corona up to 6 solar radii. (auth)

8129 SPECTRAL CHARACTERISTICS OF FLARES. Schoolman, S.; Title, A. (Lockheed Solar Observatory, Burbank, CA). pp 147-149 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

A technique is presented for obtaining H-alpha spectral profiles of solar flares. A multislit spectrograph, which can take spectra every 15 seconds, is described along with a data reduction method utilizing a very fast microdensometer and a computer. The technique is illustrated with a spectral analysis of the solar flare of September 5, 1973. (IAA)

8130 NUMERICAL SIMULATION OF INTERPLANETARY SHOCK ENSEMBLES. Steinolfson, R. S. (Space Environment Lab., Boulder, CO); Dryer, M.; Nakagawa, Y. pp 175-178 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

The shock pair observed by the HEOS 1 satellite on March 25, 1969, is modeled using a time-dependent numerical analysis. In order to reproduce the observed large-scale structure, it is necessary to include the interplanetary magnetic field and azimuthal velocity in the analysis and to account for nonradial shock velocities in the modeling procedure. The initial disturbance is located at 0.84 AU in the simulation and of such a magnitude that the solar wind observed by the satellite at 1 AU following passage of the shock pair is produced from that observed preceding it. The forward shock reaches 1 AU approximately 12 hours after initiation of the disturbance. (auth)

8131 INSTABILITIES CONNECTED WITH NEUTRAL SHEETS IN THE SOLAR WIND. Formisano, V. (CNR, Frascati, Italy). pp 180-186 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

A preliminary study is presented of two sets of data obtained by HEOS 1 and OGO 5 in the solar wind, which reveal the internal structure of two neutral sheets and their two-dimensional structure. HEOS 1 observations of the effects of the tearing mode instability in one of the sheets are described, including complicated structures connected with the sector boundary, sharp increases and decreases in the magnetic field intensity, and the presence of closed loops. HEOS 1 and OGO 5 observations of large oscillations due to plasma pressure imbalances are discussed, and it is concluded that an interchange instability may have been observed. (IAA)

8132 SUPRATHERMAL PARTICLES. Lin, R. P. (Univ. of California, Berkeley). pp 187-194 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Recent observations of suprathermal particles in the interplanetary medium in the energy range from solar wind (above about 1 keV to low energy solar cosmic rays (about 1 MeV) are reviewed. A crude classification of the types of observed fluxes is given, and the sources of the suprathermal particle populations and energy contained in them are discussed. Among the possible interactions of these particles with the solar wind plasma, the particular interaction which generates type III solar radio bursts is analyzed. (auth)

8133 EFFECT OF MAGNETIC FORCE ON SOLAR WIND EXPANSION. Yeh, T. (National Center for Atmospheric Research, Boulder, CO). pp 196-200 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

A family of critical solutions for isothermal magnetized solar wind with azimuthal motion is calculated, ranging from zero to very large magnetic fluxes. The result indicates that the magnetic force enhances the solar wind expansion and the enhancement is more eminent at lower temperatures. (auth)

8134 TWO VIEWS OF COSMIC RAY PROPAGATION IN THE SOLAR SYSTEM. Barouch, E. pp 206-213 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Two theories explaining the origin of cosmic-ray variations are compared: the diffusion theory, in which the variations are attributed to small-angle scattering by numerous irregularities in the interplanetary magnetic field (IMF), and the scatter-free theory, in which they are attributed to large directional and intensity changes caused by a few scattering centers. The evolution of both theories is outlined, and observational evidence is presented which tends to support the diffusion theory. A model for the scatter-free theory is constructed, wherein blobs of highly magnetized material develop in the IMF and drastically change the direction and pitch angles of incident cosmic rays. It is noted that neither model can be definitively accepted or rejected, and a table comparing the two viewpoints is presented. (IAA)

8135 SOLAR WIND AS DEDUCED FROM LUNAR SAMPLES. Eberhardt, P. (Univ. of Chicago). pp 58-67 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Lunar surface samples, which have been exposed to the solar wind, can be used to obtain information on the recent and past solar wind. Some of the more important conclusions reached are: The D/H ratio in the solar wind is smaller than 0.000003. The isotopic composition of C, Ar (except Ar-40), and Kr in the solar wind and on the earth are the same within approximately plus or minus 3 percent. Terrestrial Ne is enriched in the heavier isotopes relative to solar wind Ne. The average solar wind flux in the past was probably higher than at present. The average solar wind energy has varied in the past; however, no long time trend is apparent. Evidence for a secular decrease of the $^4He/^3He$ ratio with time exists. (IAA)

8136 TRAVELLING SOLAR RADIO BURSTS. Stone, R.G. (Goddard Space Flight Center, Greenbelt, MD). pp 72-97 of Solar Wind Three. Russell, C.T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

This review considers the properties of solar radio bursts originating in the outer corona and interplanetary medium between approximately 0.5 solar radius and one AU from the sun as observed between meter and kilometer wavelengths. Traveling radio bursts, such as type II's, III's, moving IV's, and noise storms, are of interest in their own right as they relate to questions of the generation of nonthermal coherent emission and the transport of radiation in an astrophysical plasma. In the context of this review, however, emphasis will be on how traveling radio bursts provide information on the solar plasma environment, gross magnetic field configuration, and disposition of solar ejecta along the trajectory of the radio source as it propagates outward through the solar atmosphere. (auth)

8137 CORONAL STRUCTURE AND THE SOLAR WIND. Roelof, E. C. (Univ. of New Hampshire, Durham). pp 98-131 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Aspects concerning the open coronal structure and geomagnetic disturbances are considered along with the general coronal emission characteristics and relations between the open coronal structure and the interplanetary field. The nonstatistical indicators of coronal structure are examined and questions are investigated regarding the accuracy obtained in the determination of the emission latitude and longitude in the high corona for plasma, fields, and particles. Attention is given to the problem of particle population organization by low-coronal neutral line structures in the absence of a high coronal polarity structure. (IAA)

8138 INTERPLANETARY DISTURBANCES: A CLASSIFICATION. Gosling, J. T. (High Altitude Observatory, Boulder, CO). pp 140-143 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Solar wind disturbances are classified according to the presence of a shock wave, helium enrichment, and anomalously low solar wind proton temperatures. Disturbances containing at least two of these characteristics are defined as flare-produced disturbances and all other nonrecurrent disturbances are categorized as minor disturbances. A flare-produced disturbance model is constructed, and it is shown that such disturbances are caused by large H-alpha flares accompanied by Type II and (less often) Type IV radio bursts. These disturbances almost invariably produce Forbush decreases of the galactic cosmic ray flux and modulate the low-energy solar cosmic ray flux. It is suggested that some minor disturbances may be due to active and eruptive prominences and surges. (IAA)

8139 EVIDENCE OF A PRIMORDIAL SOLAR WIND. Sonett, C. P. (Univ. of Arizona, Tucson). pp 36-57 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

A model is reviewed which requires a T Tauri "wind" and at the same time encompasses certain early-object stellar features. The theory rests on electromagnetic induction driven by the "wind". Plasma confinement of the induced field prohibits a scattered field, and all energy loss is via ohmic heating in the scatterer (i.e., planetary objects). Two modes, one caused by the interplanetary electric field (transverse magnetic) and the other by time variations in the interplanetary magnetic field (transverse electric) are present. Parent body melting, lunar surface melting, and a primordial magnetic field are components of the proposed model. (IAA)

8140 MEASUREMENT OF HEAVY SOLAR WIND PARTICLES DURING THE APOLLO 17 MISSION. Zinner, E. (Washington Univ., St. Louis); Walker, R. M.; Borg, J.; Maurette, M. pp 27-32 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Fluxes of solar wind particles are reported, which are based on analysis of mica detectors used in the Apollo 17 Lunar Surface Cosmic Ray Experiment. The two etching times and observational methods employed to study particles in different mass ranges are described, and the mass dependence of the pit depths is noted. An Fe-group flux in the solar wind is derived and an Fe/H ratio is obtained by combining this flux with the average solar wind proton flux. A crude upper limit is made for the CNO abundance, and a corresponding CNO/H ratio is shown to be 2.5 times the solar system value. (IAA)

8141 RELATION OF SOLAR WIND FLUCTUATIONS TO DIFFERENTIAL FLOW BETWEEN PROTONS AND ALPHAS. Neugebauer, M. (California Inst. of Tech., Pasadena). pp 33-34 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

An analysis is made of the difference between the alpha particle and proton flow velocities in the solar wind as observed by the OGO 5 satellite. The alpha and proton velocities from each of 962 spectral scans are compared with the variance of 32 solar wind flux measurements made during the scans. The average velocity difference is plotted for each of 10 logarithmic variance intervals and is seen to decrease and approach zero when the variance is high. It is shown that such an anticorrelation may be due to the fact the wave/particle interactions provide the drag force between two streams of different velocity in a collisionless plasma. (IAA)

8142 NONLINEAR HYDROMAGNETIC WAVE EVOLUTION IN THE SOLAR WIND. Cohen, R. H.; Kulsrud, R. M. (Princeton Univ., NJ). pp 382-384 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

In nonlinear hydromagnetic theory, an arbitrary fluctuation propagating along the mean field direction steepens into shocks and evolves subsequently into a purely Alfvenic fluctuation of lower mean energy density. A class of smoothly varying initial fluctuations evolves into rotational discontinuities. For parameters appropriate to the solar wind, the time scale for conversion into Alfvenic fluctuations is, at most, of the order of the time for waves to travel 1 AU. The energy dissipated in the process may account for an appreciable fraction of the observed ion thermal-energy density at 1 AU. (auth)

8143 FINE STRUCTURE OF SOLAR WIND VELOCITY. Lotova, N. A.; Chashei, I. V. (Inst. of Physics, Moscow). pp 375-381 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

A new method of investigating and analyzing the structure of velocities in the solar wind is proposed. It is based on determining the shape of the temporal scintillation cross-correlation function. It calculates the distribution of irregularity velocities along the line of sight, which velocities describe the solar wind outflow. The dependence of the skewness of the cross-correlation function on parameters describing the velocity structure in the interplanetary medium is established. (IAA)

8144 SOLAR WIND MODEL PREDICTIONS FOR THE SOURCES OF STREAMS OBSERVED AT 1 AU: CORONAL ENHANCEMENTS OR CORONAL HOLES. Jones, D.E.; George, R.G. (Brigham Young Univ., Provo, UT). Utah Acad. Sci., Proc.; 51: 169-180 (1974).

The present paper discusses attempts which have been made to locate the solar sources of the solar wind streams observed at or near 1 AU. Solar-wind data collected by the Mariner 2, Mariner 5, and IMP-1 spacecraft are considered. It is concluded that the type of solar feature considered as the source of solar-wind velocity enhancements depends upon the solar-wind model used. All single-fluid models predict the source to have a significantly higher temperature and lower density than the surrounding region, while the two-fluid model predicts a change in temperature that is much smaller than the predicted change in density. (IAA)

Galaxies

Refer also to abstracts 7946, 7960, 8045, 8056, 8062, 8064, and 8167.

8145 (N-75-12861) STELLAR CONTENT OF THE NUCLEI OF ELLIPTICAL GALAXIES DETERMINED FROM 2.3 MICRON CO BAND STRENGTHS. Frogel, J. A.; Persson, S. E.; Aaronson, M.; Becklin, E. E.; Matthews, K.; Neugebauer, G. (Smithsonian Astrophysical Observatory, Cambridge, Mass. (USA)). 1974. 15p. (NASA-CR-140859). NTIS $3.25.

Observations of the luminosity sensitive CO absorption band at

2.3 micron are presented for the nuclei of 16 epsilon and SO galaxies. Preliminary data on the radial variation of the CO index in 6 galaxies are also given. The data show that the 2-u radiation from the nuclei is dominated by high luminosity stars of integrated spectral type later than K5. There is only a small variation in the CO absorption from galaxy to galaxy, and only a slight variation with measuring aperture size from 17.5 in. to 59 in. The data can be used to synthesize stellar populations for elliptical galaxy nuclei. (auth)

8146 RADIO OBSERVATIONS OF IC 434. Kuiper, T. B. H. (California Inst. of Tech., Pasadena). Astron. Astrophys.; 42: No. 3, 323-327(Sep 1975).

Continuum radio emission and hydrogen recombination line emission were measured at 2.37 GHz with the 64-m antenna at Goldstone. The radio emission has the same general distribution as the optical nebula. The radial velocity of the nebula agrees with that of the adjacent dust cloud L 1630. The electron temperature is estimated to be approximately 7000 K. The excitation of the nebula is compared with current estimates of the ionizing flux from the exciting star, σ Orionis. (auth)

8147 RADIATION DENSITY AND LIFETIMES OF MOLECULES IN INTERSTELLAR DUST CLOUDS. Sandell, G. (Helsinki Univ. of Tech.); Mattila, K. Astron. Astrophys.; 42: No. 3, 357-364(Sep 1975).

The radiation field in dust clouds as a function of cloud extinction is computed using the Monte Carlo method and recent results for the scattering properties of grains. This is used to recalculate the photodissociation lifetimes for a number of molecules in interstellar dust clouds. The results show that shielding by dust is not as efficient as commonly believed. For molecules in dense dark clouds ($A_V \approx 8^m$) we obtain lifetimes which are typically by a factor of $\sim 10^4$ shorter than the lifetimes obtained in the earlier calculations of Stief et al. (1972). Some comments are made concerning the theory by Watson and Salpeter (1972a, b) on the molecule formation on surfaces of interstellar grains. (auth)

8148 HIGH RESOLUTION NEUTRAL HYDROGEN OBSERVATIONS OF NGC 4258. van Albada, G. D.; Shane, W. W. (Leiden Observatory). Astron. Astrophys.; 42: No. 3, 433-439(Sep 1975).

In this paper preliminary results of 21 cm line observations of NGC 4258 obtained with the Westerbork Synthesis Radio Telescope are presented. Disturbances in both the HI density distribution and the velocity field in the neighborhood of the anomalous arms tend to support the expulsion model of Van der Kruit et al. (1972). Outside the region of the anomalous arms the galaxy behaves like a normal spiral galaxy. (auth)

8149 INTERPRETATION OF THE RADIO- AND IR-SPECTRUM OF THE COMPACT H II REGIONS W 3 (A) AND W 3 (OH). Kruegel, E. (Univ., Goettingen, Ger.); Mezger, P. G. Astron. Astrophys.; 42: No. 3, 441-448(Sep 1975).

Models are fitted to the observed integral characteristics and radio and IR spectra of the compact H II regions W 3 (A) and W 3 (OH). W 3 (OH) appears to be ionized by an O-star, which has not yet reached the main sequence. It is surrounded by a compact, dust-depleted H II region. Some distance outside the H II region is a dense shell of gas and dust whose inner radius is between 20 to 40 times the radius of the compact H II region. There does not appear to be a strong density gradient in the ionized gas. W 3 (A) is surrounded by a dense, dust-enriched shell of ionized gas which is embedded in a dense cloud of neutral gas and dust. The diameter of the ionized shell is comparable to the diameter of the neutral shell surrounding the compact H II region W 3 (OH). The two H II regions appear to represent two different stages in the dynamical evolution of compact H II regions in which dust plays the dominant role. Some characteristics of the dust are obtained. (auth)

8150 GALACTIC ROTATION AND LOCAL IRREGULARITIES DERIVED FROM FUNDAMENTAL PROPER MOTIONS AND RADIAL VELOCITIES. Fricke, W.; Tsioumis, A. (Astronomisches Rechen- Institut, Heidelberg). Astron. Astrophys.; 42: No. 3, 449-455(Sep 1975).

Proper motions and radial velocities of FK 4/FK 4 Sup stars of the disk population have been analyzed in the distance intervals 70 to 300 pc and 300 to 1300 pc. The stars at large distances are concentrated to the galactic plane, their motions confirm the values of Oort's constants A and B ($+14.2 \pm 2.8$, -11.8 ± 2.8 km s^{-1} kpc^{-1}) derived by Fricke (1967). The stars nearer than 300 pc are concentrated towards the Gould Belt; they all together do not yield significantly different rotation parameters than the stars at large distances. Even the stars assumed to be members of the Gould Belt by Lesh (1968, 1972) do not yield rotation parameters different from those of the "Non Lesh Stars." However, the motions of the nearby stars younger than 4×10^7 years deviate strongly from galactic rotation. The explanation of a significant K term found in agreement with Lesh remains uncertain; the occurrence of nearby groups with diverging motions appears to offer a more realistic explanation than an expansion from a point source. (auth)

8151 ROTATIONAL INTERPRETATION OF RECOMBINATION LINE WIDTHS IN THE GALACTIC NUCLEUS. Kellman, S. A. (National Aeronautics and Space Administration, Moffett Field, CA); Durisen, R. H. Astron. Astrophys.; 42: No. 3, 467-469(Sep 1975).

The widths of the radio recombination lines observed in the direction of the galactic center are interpreted as due to pure rotation. This interpretation leads to a mass estimate for the inner 1.6 pc region of our galaxy. It is noted that recent observations of M 31 suggest the existence of a distinct dynamic entity at its center—the nucleus. The rotational interpretation of the recombination line widths is shown to be consistent with the existence of a nucleus at the center of our own galaxy which is similar in nature to the nucleus of M 31. (auth)

8152 FIELD GALAXIES AND CLUSTER GALAXIES: ABUNDANCES OF MORPHOLOGICAL TYPES AND CORRESPONDING LUMINOSITY FUNCTIONS. Neyman, J.; Scott, E. L. (Univ. of California, Berkeley). pp 129-140 of Confrontation of Cosmological Theories with Observational Data. Longair, M. S. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on confrontation of cosmological theories with observational data; Krakow, Poland (10 Sep 1973).

Formulas for estimating abundances of morphological types and space luminosity functions are derived on the basis of a theory developed by Neyman and Scott (1962) for homogeneous classes of galaxies, i.e., of galaxies so finely defined that the probability of a galaxy of this class being included in the catalog depends solely on its photographic apparent magnitude. The practical use of the theory is demonstrated, using data from the HMS Catalog. It is found that certain combinations of the Hubble morphological types appear to satisfy the definition of a homogeneous class. (IAA)

8153 SCALE HEIGHT OF INTERSTELLAR IONIZED HYDROGEN. Readhead, A. C. S.; Duffett-Smith, P. J. (Cavendish Lab., Cambridge, Eng.). Astron. Astrophys.; 42: No. 1, 151-153(Aug 1975).

New observations of interstellar scattering at 81.5 MHz and 151.5 MHz are used to determine the scale height of the free electron layer in the Galaxy. A value of 430 pc to 670 pc is derived for the scale height, and the dispersion measure perpendicular to the plane is shown to be between 15 cm^{-3} pc and 19 cm^{-3} pc. The limit imposed by the scattering on observations of extragalactic radio sources is discussed. (auth)

8154 GALACTIC DYNAMO. Stix, M. (High Altitude Observatory, Boulder, CO). Astron. Astrophys.; 42: No. 1, 85-89(Aug 1975).

The generation of mean magnetic fields by an $\alpha\omega$-dynamo is studied in the geometry of an oblate spheroid. Applied to the galaxy, the model has the steady, quadrupolar (even) mode as the most easily excited mean field, in agreement with results obtained by Parker from a plan-parallel model. However, oscillatory modes which were reported by Parker to occur under similar excitation conditions, exist in the present model only at substantially larger dynamo numbers. (auth)

8155 DETECTION OF A 21 CM ABSORPTION LINE AGAINST THE SUGGESTED GALAXY/QSO PAIR NGC 3067/3C232. Grewing, M. (Univ., Bonn); Mebold, U. Astron. Astrophys.; 42: No. 1, 119-125(Aug 1975).

The 21 cm line emission of the four suggested galaxy/QSO pairs NGC 3067/3C232, NGC 4138/3C268.4, NGC 4651/3C275.1 and NGC 5832/3C309.1 has been studied with the Effelsberg 100-m telescope. In the case of the first pair, a narrow absorption feature at $v_{LSR} = 1411$ km s^{-1} was found. The physical implications of our results as to the reality of the galaxy/QSO associations are discussed. (auth)

8156 DETERMINATION OF THE DUST ABUNDANCE FROM MIDDLE INFRARED MEASUREMENTS. Panagia, N. (Laboratorio di Astrofisica Spaziale, Frascati, Italy). Astron. Astrophys.; 42: No. 1, 139-143(Aug 1975).

The effects of a temperature range on the effective emissivity of grains have been considered. We find that the use of the color temperature as the physical temperature of grains for the interpretation of middle infrared data ($\lambda \approx 10\mu$) leads to serious underestimates of the dust mass inside H II regions (typically by a factor of 20). As a consequence, the corrected abundance

of dust relative to the gas turns out to be similar to that of the interstellar medium. It also agrees well with the determinations obtained from far infrared data. (auth)

8157 GALACTIC HALO: GLOBULAR CLUSTERS. Woltjer, L. (Columbia Univ., NY). Astron. Astrophys.; 42: No. 1. 109-118(Aug 1975).

The distribution of globular clusters is studied. Individual distances are redetermined on the basis of available data and an adopted $M_v = +0.6$m for RR Lyrae stars. Both metal poor (H) and comparatively metal rich (D) clusters appear to have an essentially spherical distribution with the D clusters concentrated close to the galactic center, except for a few cases. Kinematical data are consistent with the spatial density distributions if a value of Θ_c for the LSR of 200-225 km/s (for $R_\odot = 9$ kpc) is adopted. The mass density in the globular cluster system declines sharply beyond 20 kpc from the center. Estimates of the mass of the halo are made. While it is quite possible that the mass of the halo exceeds that of the disk, there is no evidence that the mass of the galaxy exceeds previous estimates by a substantial amount. (auth)

8158 MASSES OF THE GALAXY AND THE MASS-ENERGY IN THE UNIVERSE. Burbidge, E. M. (Univ. of California, La Jolla). pp 473-486 of Astrophysics and Gravitation. Brussels; Editions de l'Universite de Bruxelles (1974).

From 16th Solvay conference on physics; Brussels, Belgium (24 Sep 1973).

8159 ISOTOPE ABUNDANCES IN INTERSTELLAR MOLECULE CLOUDS. Wannier, P. G. Princeton, NJ; Princeton Univ. (1975). 79p. University Microfilms Order No. 75-23,249.

Thesis (Ph. D.).

The J equals 1 yields J equals 0 transition of carbon monoxide is used to study the double isotope ratio $[^{13}C][^{16}O]/[^{12}C][^{18}O]$ in large molecular clouds. Very high quality spectra were obtained of $^{12}C^{16}O$ (CO), $^{13}C^{16}O$ (^{13}CO) and $^{12}C^{18}O$ ($C^{18}O$) near 14 HII regions distributed throughout the galactic plane. Effects of line saturation are carefully examined and it is found that the ^{13}CO species often produces a slightly saturated line. When saturation is properly taken into account, the data indicate that a single value of 12.5 for the $[^{13}C][^{16}O]/[^{12}C][^{18}O]$ abundance ratio applies generally. This value is significantly different from the corresponding terrestrial ratio of 5.6 and we suggest that the difference results from chemical evolution having occurred in the Galaxy since the birth of the Solar System. From a variety of other isotope studies we conclude that the value of $[^{12}C]/[^{13}C]$ is likely to be approximately 40 as compared with the terrestrial value of 89. This difference would account for our high observed value of $[^{13}C][^{16}O]/[^{12}C][^{18}O]$. (Diss. Abstr. Int., B)

8160 COLLISIONS OF GALAXIES IN DENSE CLUSTERS: MORPHOLOGICAL EFFECTS. Richstone, D. O. Princeton, NJ; Princeton Univ. (1974). 66p. University Microfilms Order No. 75-23,235.

Thesis (Ph. D.).

A number of numerical simulations of collisions of spherical galaxies have been conducted. Test stars representative of the model galaxy were selected by a Monte Carlo technique and followed through the collision by integrating their equations of motion, within the approximations that the stars react only to the smoothed out mass distributions of the galaxies, and that those distributions are unchanged during the collision. Approximate analytic arguments based on the impulsive approximation have been used to extend the numerical results. The application of the results of the numerical and analytic investigation of single collisions to galaxies residing in dense clusters has yielded a number of striking results. If the galaxies start out with extended halos 500 kpc in extent that encompass all the mass in the cluster, about 90 percent of the mass and 25 percent of the luminosity is liberated in a Hubble time. The properties of this intergalactic material suggest that it is properly identified with the halo of the cD galaxy. The internal velocity dispersions of the stripped galaxies should be lower than the initial dispersion. The details of the above results depend on the validity of the King model approximation after substantial mass loss has occurred. Finally two-body relaxation—in this case galaxy-galaxy encounters—should become important on the same timescale. The results obtained are suggestive of identifying either the Bautz-Morgan contrast classification or Oemler's morphological classification as density sequences, or equivalently sequences of increasing importance of dynamical or collisionsl effects on the cluster galaxies. (Diss. Abstr. Int., B)

8161 GEOMETRIC ASPECT OF HUBBLE'S PHENOMENON. Konitz, H. (Medizinische Hochschule, Hanover). Found. Phys.; 5: No. 1, 185-191(Mar 1975).

The conventional interpretation of the Hubble effect as a Doppler effect, based upon the concept of an expanding universe or based upon the idea of a continuously increasing radius of curvature of space, leads to some difficulties. It seems possible to avoid these difficulties by ascribing the redshift of light coming from remote galaxies to the fact that the non-Euclidean structure of the universe gets more and more important as observation extends to regions extremely distant from the point of observation. Hubble's phenomenon thus seems based upon the structure of space and time as judged from the point of observation; this means that it appears as a consequence of the "geometria intrinsica" of the universe. (auth)

8162 COMPUTATION OF MOLECULAR ABUNDANCES IN INTERSTELLAR CLOUDS. Barsuhn, J. (Max-Planck Institut fuer Radioastronomie, Bonn). Mitt. Astron. Ges.; No. 35, 197-203(1974). (In German)

It is pointed out that cold interstellar H I clouds with densities in the range from 10 to 1,000 atoms/ccm are not in thermodynamic equilibrium. Reactions induced by the radiating fields of near-by stars or by cosmic radiation proceed, therefore, in the clouds often faster than other chemical processes. The investigation reported is concerned with the computation of the abundances of molecular hydrogen and HD. Attention is also given to questions regarding the equilibrium between hydrogen in the ortho-state and the para-state. (IAA)

8163 THERMAL BEHAVIOR OF INTERSTELLAR GASES IN THE VICINITY OF STELLAR MASSES. Fahr, H. J. (Univ., Bonn). Mitt. Astron. Ges.; No. 35, 193-196(1974). (In German)

The interstellar gas, if subjected to the effect of a non-compensated gravitational field, will experience thermal and dynamical changes when passing through areas in the vicinity of stellar masses. In the case of the sun, an investigation shows the existence of a thermally greatly disturbed region with a leeward extension of about 200 AU. The gas entering the solar system reaches a temperature of about 100,000 K on the leeward side of the earth orbit, taking into account an initial gas temperature of 1,000 K. The approaches used in the computations are discussed. (IAA)

8164 EVOLUTION OF THE INTERSTELLAR MAGNETIC FIELDS. Hu, W. J. (Inst. of Mechanics, Peking). Wu-li; 4: No. 2, 102-106(18 Apr 1975). (In Chinese)

Based on a review of the phenomena of magnetic fields and interstellar magnetic fields in the universe, the author discusses the primary field theory and the seen magnetic field theory that attempt to explain the evolution of interstellar magnetic fields, and their inadequacy, and the importance of interstellar magnetic field to astrophysics. (JPRS)

8165 STATIC EQUILIBRIA OF THE INTERSTELLAR GAS IN THE PRESENCE OF MAGNETIC AND GRAVITATIONAL FIELDS. Mouschovia, T. C. Berkeley, CA; Univ. of California (1975). 227p. University Microfilms Order No. 75-22,565.

Thesis (Ph. D.).

No exact self-consistent equilibrium calculations exist for (any model of) the system of the interstellar gas and the frozen-in magnetic field. On a large scale (approximately 1 kpc) this system is affected by the vertical galactic gravitational field, while on a small scale (approximately 1 pc) the self-gravitation of the gas comes into play and is responsible for the collapse of some clouds to form stars. Accessible equilibrium states are determined for the gas-field system on both of these scales. In each case the main conclusions are summarized as follows. Final equilibrium states of the gas-field system in the galactic gravitational field can be reached after a magnetic Rayleigh-Taylor instability develops. Equilibrium states are determined for massive interstellar clouds, whose electrical conductivity is extremely high. Problems related to the formation of interstellar clouds are discussed as well as star formation. The observed inefficiency of the star formation process cannot be attributed to the birth of an O 7, or an earlier type star within a collapsing cloud, but can naturally be explained by magnetic effects in a contracting and, therefore, nonuniform cloud. (Diss. Abstr. Int., B)

Cosmology

Refer also to abstracts 7977, 8007, 8039, 8244, and 8643.

8166 GRAVITATIONAL WAVES AND RADIATIONS: INTERNATIONAL CONFERENCE, UNIVERSITE DE PARIS VII, PARIS, FRANCE, JUNE 18-22, 1973, TRANSACTIONS. Colloques Internationaux, No. 220. Paris; Centre National de la Recherche Scientifique (1974). 394p. (In French and English). $28.50.

Theoretical treatments and experimental detection of gravita-

tional waves are reported. Some of the topics covered concern: issues in gravitational wave detection with space missions, gravitational wave tails, experiments and observations with wide-band gravity wave detectors, classical general relativity as a consequence of quantum theory, recent developments in the cosmology of antimatter, a proposed standardization of gravitational burst detector signals, and a radiating Kerr–Schild metric. (IAA)

8167 OBSERVATIONAL FOUNDATIONS OF INHOMOGENEOUS UNIVERSE. Flin, P.; Machalski, J.; Maslowski, J.; Urbanik, M.; Zieba, A.; Zieba, S. (Astronomical Observatory, Krakow). pp 121-128 of Confrontation of Cosmological Theories with Observational Data. Longair, M. S. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on confrontation of cosmological theories with observational data; Krakow, Poland (10 Sep 1973).

The distribution of galaxies and radio sources is analyzed on the basis of recent observational data obtained at optical and radio frequencies. It is shown that there is a pronounced nonrandom surface distribution of galaxies, regardless of the scale of the field investigated. The distribution of galaxies exhibits a continuous hierarchial structure and, therefore, the description of galaxies should be based on density indices rather than on not precisely defined clusters of galaxies. In the radio-frequency domain, the distribution of radio sources in the GB region is studied, together with the number/flux density ratios obtained for the various subregions. (IAA)

8168 CREATION OF PARTICLES IN COSMOLOGY. Zel'dovich, Ya. B. (Inst. of Problems in Materials, Moscow). pp 329-333 of Confrontation of Cosmological Theories with Observational Data. Longair, M. S. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on confrontation of cosmological theories with observational data; Krakow, Poland (10 Sep 1973).

A particular example of the impact of quantum mechanics on cosmological theory is presented. A new approach to quantum corrections to the gravitational field equations is developed which is equivalent to the introduction of viscosity to space time, and in which the additional energy-stress components are proportional to the time derivatives of the curvature. (IAA)

8169 CONCLUDING REMARKS. Rees, M. J. (Cambridge Univ., Eng.). pp 359-365 of Confrontation of Cosmological Theories with Observational Data. Longair, M. S. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. 1974).

From conference on confrontation of cosmological theories with observational data; Krakow, Poland (10 Sep 1973).

The current state of cosmology is examined, taking into account the information about the early universe provided by the microwave background, alternative hypotheses concerning initial curvature fluctuations, conditions at very early epochs, the origin of entropy, and questions of pair creation in regions of extreme space curvature. Attention is given to a highly isotropic universe, the significance of the radio source counts, the distribution of quasars, evidence for noncosmological redshift, and promises of X-ray astronomy concerning the study of the amount and clumping of intergalactic gas. (IAA)

8170 OBSERVATIONAL FOUNDATIONS FOR ASSUMPTIONS IN COSMOLOGY. Heller, M.; Klimek, Z.; Rudnicki, K. (Astronomical Observatory, Krakow). pp 3-11 of Confrontation of Cosmological Theories with Observational Data. Longair, M. S. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on confrontation of cosmological theories with observational data; Krakow, Poland (10 Sep 1973).

The applicability of the Cosmological Principle to the distribution of matter in the universe is tested in the first approximation, assuming a flat (Euclidean) geometry of the universe. In the second approximation, the applicability of the Cosmological Principle to a model applicable to regions established in the first approximation is tested. (IAA)

8171 CONFRONTATION OF COSMOLOGICAL THEORIES WITH OBSERVATIONAL DATA. Proceedings of the Symposium, Krakow, Poland, September 10–12, 1973. Longair, M. S. (ed.). IAU Symposium, No. 63. Dordrecht, Netherlands; D. Reidel Publishing Company (1974). 390p. $46.40.

The papers deal with problems that derive from the hot big bang model of the universe. The major issues studied are structure and dynamics of the universe, the relic radiation, the origin of structure in the expanding universe, the structure of singularities, and the physical processes near a singularity. The discussions include the choice between open and closed models, the nonuniform distribution of matter (in particular, the clustering of galaxies), the origin of galaxies, and the rotation and magnetic fields of galaxies. (IAA)

8172 HIGHLY ORDERED UNIVERSE. Bell, A. B. (Drexel Univ., Philadelphia); Bell, D. M. Found. Phys.; 5: No. 3, 455-480(Sep 1975).

A highly ordered universe is described in terms of neutrino and electrino alone as basic particles, and length and time alone as dimensional units. New theories are obtained of particles, nuclides, atomic spectra, general relativity, and gravitation. (auth)

8173 DIRECTION OF TIME. Mirman, R. Found. Phys.; 5: No. 3, 491-511(Sep 1975).

The meaning of the phrase "the direction of time" and the physical problems involved are considered. These problems are discussed, and plausibility arguments are given to show that all clocks run in the same direction (almost always), that the most probable development of the universe during the early stages of the expansion would result in the introduction of some internal organization, and that the expansion of the universe and the increase in entropy define time directions that have the same sense. The question of what properties of the laws governing the universe lead to these results is studied. (auth)

8174 ORIGIN OF PLANETARY NEBULAE. Vila, S. C. (Univ. of Pennsylvania, Philadelphia). Mem. Soc. R. Sci. Liege; 8: 391-395(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Static models have been constructed for giant star envelopes of luminosities greater than $10^4 L_\odot$ using the mixing length, pressure scale height theory of convection. A density inversion appears in the convective zone. This inversion increases with increasing luminosity of the model and eventually produces a detached shell. The mass of the shell is similar to the observed mass of planetary nebulae shells. The remnant star has a luminosity and effective temperature similar to the one observed for the central stars of planetary nebulae. It is suggested that planetary nebulae might be produced by this process. (3 tables) (auth)

8175 STABILITY LIMIT OF PLANE-PARALLEL AND INFINITE GRAVITATING MEDIA. Callebaut, D. K. (Univ., Antwerpen, Beligium). Mem. Soc. R. Sci. Liege; 8: 467-476 (1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

The gravitational energy of an infinite cylinder, of an infinite plane-parallel medium and of a medium infinite in all directions is infinite in each case, even per unit fraction. Similarly the potential energy per sphere of one-, two- and three-dimensional arrays of equal gravitating spheres is divergent, each in a similar way as its corresponding homogeneous configuration. For "cubical" arrays it is shown that the difference in potential energy per unit fraction is finite for each set of corresponding configurations. On the other hand, for "parallelopipedal" arrays an infinite difference in potential energy (logarithmic divergence) is found in the case that the media are infinite in all directions. Some conclusions concerning the lowest stability which is energetically possible are given: if it is non-zero finite fragments result when instability occurs. The occurring divergencies may give some support to the use of a cosmological constant. (auth)

8176 PRESUPERNOVA DYNAMICAL MASS EJECTION BY NON-DETONATED STELLAR CORES. Buchler, J. R. (Yeshiva Univ., New York); Mazurek, T. J. Mem. Soc. R. Sci. Liege; 8: 435-445(1975).

From international conference on astrophysics; Liege, Belgium (9 Jul 1974).

Stars in the range of 4 to 8 solar masses are known to develop degenerate carbon-oxygen cores of about 1.4 $M_\odot$. Arguments are presented why, contrary to past assumption, carbon ignition may not lead to the formation of a detonation wave. Rather, an initially subsonic burning front results which subsequently may be brought under control by adiabatic expansion. This dynamic phase leads to a centrally incinerated and expanded core. The loosely bound red giant envelope is ejected to form an extended nebula. Neutrino cooling of the core finally induces collapse. Provided that sufficient energy is liberated in the dynamic formation of a neutron star, a supernova event will result. The distended nebula is ideally suited for the production of the visible supernova light curves. Thus, carbon non-detonation may give a viable alternative evolution to supernova that avoids the impasse encountered by the detonation disrupted models. (5 figures, 1 table, 24 references) (auth)

8177 EXPLOSIVE THERMONUCLEAR FORMATION OF ^{7}Li AND ^{11}B. Arnould, M.; Norgaard, H. (Univ., Brussels). Astron. Astrophys.; 42: No. 1, 55-70(Aug 1975).

In the framework of [illegible]rnett's (1969) model, the post-shock explosive nucleosynthesis of hydrogen-rich layers is investi-

gated with particular emphasis on the thermonuclear production of ^{7}Li and ^{11}B. Rather large ranges of peak temperatures and densities are shown to be consistent with the production of ^{7}Li or ^{11}B by this mechanism. Particularly in the ^{7}Li case, the overproduction with respect to the solar composition is often appreciable. As far as ^{11}B is concerned, the results depend rather sensitively on the choice of the explosive expansion time scale parameters and on the uncertainties in the $^{11}C(p, \gamma)^{12}N$ rate. In fact, our study shows that the probability of a substantial ^{11}B production increases with decreasing explosion time scale (for a given peak density) and decreasing rate of the proton capture by ^{11}C. It is also demonstrated that there exists a range of temperature-density conditions ($T_0 \simeq 4-6 \times 10^{8}$K; $\rho_0 \simeq 1-10^{3}$gcm^{-3}) for which the enhanced production of both ^{7}Li and ^{11}B—sometimes together with ^{13}C, ^{15}N and ^{17}O—occurs in relative concentrations consistent with solar system abundances (Cameron, 1968, 1973). (auth)

8178 COSMIC PRIMEVAL TURBULENCE. Chan, K. L. Princeton, NJ; Princeton Univ. (1975). 93p. University Microfilms Order No. 75-23,187.

Thesis (Ph. D.).

Two fundamental problems in the theory of cosmic turbulence are discussed in this thesis. The first problem concerns the energy spectrum of the cosmic turbulence and its evolution prior to decoupling. The turbulent dissipation of energy is studied. Generalizing the conventional physical transfer theory of turbulence to the case of expanding cosmic turbulence, it is shown that the cosmic turbulence spectrum obeys Kolmogorov's Law in the inertial range. The results of a numerical computation confirm the theory. The second problem concerns the effect of turbulence dissipation on the spectrum of the microwave background radiation. The mechanism whereby energy is transferred from decaying cosmic turbulence to the electrons and photons is studied. The distortions of the cosmic microwave background radiation spectrum resulting from turbulence energy input are then calculated analytically and numerically. The results are used to re-evaluate the constraints on the theory of cosmic turbulence imposed by observations. (Diss. Abstr. Int., B)

8179 NUCLEAR PROCESSES IN THE EARLY UNIVERSE. de Graaf, T. pp 239-250 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851—.

The cosmological models and the physical processes describing early stages of the Universe are considered. Experimental data on element abundances in the frame of the Hot Big Bang model are discussed. The element abundances of ^{2}H, ^{3}He, ^{4}He, ^{7}Li in the Universe depend on various parameters of cosmological and physical origin. The experimental values are in agreement with those calculated in the frame of the considered model. (auth)

8180 INDIRECT CONFIRMATION OF HIERARCHICAL COSMOLOGICAL MODELS. Kalinkov, M.; Stavrev, K. (Sektsiia po Astronomiia, Sofia). C. R. Acad. Bulg. Sci.; 28: No. 1, 13-16(1975).

Hierarchical cosmological models are indirectly confirmed by counting galaxies, measuring their diameters, and determining the thinning rate for the distribution of matter in the examined region of space. 6457 galaxies were counted on map 64 O of the Palomar Sky Survey, and the diameters of 3196 of them were measured. The integral luminosity function for map 64 O is derived, and the thinning rate is calculated. The rate is shown to correspond with the theoretical value proposed in hierarchical models. Results of another study of galactic clusters are also cited as proof of a hierarchical model of the universe. (IAA)

Planetary Phenomena

Refer also to abstracts 7945, 8035, 8073, 8111, 8254, and 8261.

8181 (N-75-12869) JUPITER RADIATION BELT MODELS (JULY 1974). Divine, N. (Jet Propulsion Lab., Pasadena, Calif. (USA)). 15 Nov 1974. Contract NAS7-100. 15p. (NASA-CR-40845; JPL-TM-33-715). NTIS $3.25.

Flux profiles which were derived from data returned by Pioneer 10 during Jupiter encounter, form the basis for a new set of numerical models for the energy spectra of electrons and protons in Jupiter's inner magnetosphere. (auth)

8182 (N--75-12870) JUPITER'S RADIATION BELTS AND THEIR EFFECTS ON SPACECRAFT. Parker, R. H.; Divita, E. L.; Gigas, G. (Jet Propulsion Lab., Pasadena, Calif. (USA)). 15 Oct 1974. Contract NAS7-100. 42p. (NASA-CR--140841; JPL-TM--33-708. NTIS $3.75.

The effects of electron and proton radiation on spacecraft which will operate in the trapped radiation belts of the planet Jupiter are described, and the techniques and results of the testing and simulation used in the radiation effects program are discussed. Available data from the Pioneer 10 encounter of Jupiter are compared with pre-encounter models of the Jupiter radiation belts. The implications that the measured Jovian radiation belts have for future missions are considered. (auth)

8183 (N--75-14577) RADIOACTIVE HALOS AND ION MICROPROBE MEASUREMENT OF Pb ISOTOPE RATIOS. Final Report. Gentry, R. V. (Oak Ridge National Lab., Tenn. (USA)). 1974. 2p. (NASA-CR--140384). NTIS $3.25.

The Pb isotope ratios of both lunar and meteoritic troilite grains were to be measured by utilizing ion microprobe techniques. Such direct in situ measurement of Pb isotope ratios would eliminate contamination problems inherent in wet chemistry separation procedures, and conceivably determine whether lunar troilite grains were of meteoritic origin. For comparison purposes two samples of meteoritic troilite were selected (one from Canyon Diablo) for analysis along with two very small lunar troilite grains (approximately 50-100 microns). It was concluded that the ion microprobe as presently operating does not permit the in situ measurement of Pb isotope ratios in lunar or meteoritic troilite. On the basis of these experiments no conclusions could be drawn as to the origin of the lunar troilite grains. (auth)

8184 (N-75-14695) EVOLUTION OF THE MOON: THE 1974 MODEL. Schmitt, H. H. (National Aeronautics and Space Administration, Houston, Tex. (USA). Lyndon B. Johnson Space Center). 1974. 33p. (NASA-TM-X-72192). NTIS $3.75.

From Soviet-American conference on the cosmochemistry of the moon and planets; Moscow, USSR (4 Jun 1974).

Investigations are reported of Apollo and Luna explorations which have brought about the understanding of the moon and its structure. It is shown that with this knowledge of the moon, a better understanding is presented of the earth's origin, structure and composition. (STAR)

8185 (N-75-17280) NUCLEAR REACTIONS IN COSMIC BODIES. Lavrukhina, A. K. Feb 1975. Translation of Yadernye Reaktsii v Kosmicheskikh Telakh, Nauka Press, Moscow, 1972. (NASA-TT-F-802). 432p. NTIS $11.25.

The simulation of nuclear reactions caused by cosmic rays in meteorites and the surface layers of the moon and asteroids is discussed. Calculations are made of the depth distribution of nuclear-active particles and cosmogenic isotopes in meteorites of various sizes and compositions. It is shown that nuclear reactions are the cause of the observed anomalies in the isotopic composition of elements in meteorites when compared to the composition found in Earth rocks. (auth)

8186 (N-75-18133) COMPARISON OF INFERRED AND OBSERVED INTERPLANETARY MAGNETIC FIELD, 1970--1972. Wilcox, J. M.; Svalgaard, L.; Hedgecock, P. (Stanford Univ., Calif. (USA). Inst. for Plasma Research). Dec 1974. Contract N00014-67-A-0112-0068. 20p. (NASA-CR-142152; SU-IPR-600). NTIS $3.25.

The inferred polarity (towards or away from the sun) of the interplanetary magnetic field at earth using polar observations of the geomagnetic field has been compared with spacecraft observations. A list published by Svalgaard of the inferred field polarities during 1970 through 1972 is found to be correct on 84 percent of the days. A near real time (same day) method of inferring the polarity of the interplanetary magnetic field using geomagnetic observations at Vostok and Thule is in use at the NOAA Space Environment Laboratory, Boulder, Colorado. During 1972 this method is found to be correct on 89 percent of the days. A list of well-defined sector boundaries at earth during 1970 through 1972 is given. (auth) (STAR)

8187 (N-75-20181) MAGNETIC FIELD OF MARS BASED ON DATA FROM THE MARS-5 SATELLITE. Dolginov, Sh. Sh.; Eroshenko, E. G.; Zhuzgov, L. N.; Sharova, V. A. Translated from Dokl. Akad. Nauk SSSR; 218: 795-798(1 Oct 1974). 10p. (NASA-TT-F-16232). NTIS $3.25.

Magnetometers on the spacecraft Mars-2 and Mars-3 were used to measure the magnetic fields in the immediate vicinity of the planet Mars. The results of those measurements are given along with data from the Mars-5 satellite. Other topics discussed include shock fronts, solar wind, the magnetosphere, and eigen magnetic fields. (auth)

8188 (N-75-20182) PLASMA IN THE ANTISOLAR REGION OF NEAR-MARTIAN SPACE ACCORDING TO THE MARS-5 SATELLITE MEASUREMENT RESULTS. Gringauz, K. I.; Bezrukikh, V. V.; Verigin, M. I.; Remizov, A. P. Translated from Dokl. Akad. Nauk SSSR; 218: 791-794(1 Oct 1974). 10p. (NASA-TT-F-16231). NTIS $3.25.

The preliminary results of sounding measurements of plasma ion and electron components on Mars-5 and Mars-7 are presented. The measurements were made in March 1974 in the antisolar region near Mars. (auth)

8189 (N-75-22251) OBSERVATION OF LOW-ENERGY PROTONS IN THE GEOMAGNETIC TAIL AT LUNAR DISTANCES. Hardy, D. A. (Rice Univ., Houston, Tex. (USA)). Sep 1974. Contract NAS9-5911. 127p. (NASA-CR-141732). NTIS $5.75.

Thesis.

Three suprathermal ion detectors stationed on the moon were used to detect a region of plasma flowing antisunward along the ordered field lines of the geomagnetic tail, exterior to the plasma sheet. The particle flow displays an integral flux, a bulk velocity, temperatures, and number densities uniquely different from the other particle regimes traversed by the moon. No consistent deviation in the field was found to correspond with the occurrence of the events, which have an angular distribution extending between 50 and 100 deg and a spatial distribution over a wide region in both the Y/sub sm/ and Z/sub sm/ directions. The duration of observable particles varies widely between tail passages, with an apparent correlation between the number of hours of observation and the Kp index averages over these times. It is proposed that these particles may have entered through the cusp region. (auth) (STAR)

8190 MEASURING DEVICE FOR LOW GAMMA ACTIVITIES AND ITS APPLICATION TO COSMIC SAMPLES. Schroeder, A. Cologne; Cologne Univ. (1974). 43p. (In German). INIS.

Thesis.

The design and the performance of a low level unit is described which consists of a 100 cc Ge(Li) gamma spectroscopy detector and a NaI(Tl) scintillator (diameter 12'', length 12'') and which can be operated either in coincidence or in anticoincidence. A comparison with other devices shows a considerable improvement in the limit of detection. If simple electronics is used, this limit is approximately 0.1 pCi (1 pCi = 2.22 dpm). It is shown by the example of a lunar rock sample of 2.1 g that even ppM concentrations of ^{232}Th can be detected by non-destructive techniques. Its contents of ^{22}Na, ^{26}Al and ^{232}Th was determined within a measuring time of 30,000 minutes. In addition, it is attempted to determine the incidence rate of cosmogenic dust on the surface of the earth via the ^{53}Mn content. Within a measuring time of ten days the ^{54}Mn bred through a (n,γ)-reaction is determined in a Mn sample of 54 μg obtained from 557 kg of ice from the Antarctic. For this sample, which consisted mainly of cosmic material, an upper limit of 1.2×10^{-4} dpm of ^{53}Mn is found within one standard deviation. Under simplifying assumptions, a total incidence rate of a maximum of 5×10^5 tons of cosmogenic dust per annum can be estimated from these figures. (GE)

8191 MILLISECOND POLARIZED PULSES IN DECAMETRE-WAVE RADIATION FROM JUPITER TO SUN. Barrow, C. H. (Univ. of the West Indies, Kingston, Jamaica). pp 407-413 of Exploration of the Planetary System. Woszczyk, A. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on exploration of the planetary system; Torun, Poland (5 Sep 1973).

A new approach to the theory of Jovian decametric radiation and physical conditions at the point of origin is proposed. It consists in the comparison of the characteristics of fast pulse decameter-wave radio emission from both Jupiter and the sun and invokes the deductive procedure which Sagan (1971) has called "Propositional Calculus." Fast polarized pulses in radiation from Jupiter and the sun have been studied at fixed frequencies in the range 18 to 26 MHz with time resolutions from one to five msec; a number of similarities between the pulses from both sources have been noted. A comparison of some of the pulse characteristics is being made in order to decide whether or not they are sufficiently alike to be regarded as having a common mechanism of origin at both Jupiter and the sun. From this "decision" it is proposed to establish boundary conditions for theoretical study. (IAA)

8192 JUPITER'S RADIATION BELTS AND UPPER ATMOSPHERE. Degioanni, J. J.; Dickel, J. R. (Univ. of Illinois, Urbana). pp 375-383 of Exploration of the Planetary System. Woszczyk, A. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on exploration of the planetary system; Torun, Poland (5 Sep 1973).

Models of Jupiter's radiation belts have been constructed to determine the distribution of particles and their energies which will produce the observed decimetric radio emission. Data on the spectrum and the variation of emission with Jovian longitude have been used to show that the relativistic particles have a nearly isotropic distribution with high energies (of order 100 MeV) within 2 Jovian radii and a very flat distribution in the equatorial plane of low energy particles further out in the magnetosphere. Subtraction of the emission predicted by this model from the total radio emission shows that the thermal contribution in the frequency range between 3000 and 10,000 MHz is somewhat less than had been previously expected. (The brightness temperature of the planetary disk is 180 K at 3,000 MHz, for example.) This suggests that the ammonia mixing ratio in Jupiter's upper atmosphere may be as high as 0.002. (IAA)

8193 JUPITER'S MICROWAVE SPECTRUM: IMPLICATIONS FOR THE UPPER ATMOSPHERE. Gulkis, S.; Klein, M. J.; Poynter, R. L. (California Inst. of Tech., Pasadena). pp 367-374 of Exploration of the Planetary System. Woszczyk, A. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on exploration of the planetary system; Torun, Poland (5 Sep 1973).

It is shown through the use of weighting functions that Jupiter's brightness temperature in the wavelength range 0.8-1.5 cm contains information on the thermal structure and abundance of ammonia in and above the tropopause in Jupiter's atmosphere. We present new data of Jupiter's brightness temperature in this wavelength range, and compare the results with theoretical spectra. The pressure in the Jovian atmosphere is estimated from these data to be 0.48 atm at 130 K. (IAA)

8194 MODERN RESEARCH IN HIGH RESOLUTION INFRARED SPECTROSCOPY AND ITS IMPORTANCE TO PLANETARY PHYSICS. Rao, K. N. (Ohio State Univ., Columbus). pp 41-56 of Exploration of the Planetary System. Woszczyk, A. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on exploration of the planetary system; Torun, Poland (5 Sep 1973).

The scope of research in the field of high resolution infrared spectroscopy has expanded in numerous directions in recent years. Investigations of high resolution molecular spectra performed under controlled conditions in the laboratory are of significance to planetary studies because of the high resolution which one can achieve at the present time in the spectra of planets. In making use of laboratory data it is important to develop a proper perspective; due to technological advances the quality of experimental results has improved continuously during the past two decades, and, therefore, one has to exercise proper judgement when combining information from different laboratories. Somewhat detailed discussions are presented for the spectra of CO and CO2 to illustrate what modern measurements are capable of accomplishing. This is not a comprehensive review paper but it is intended to provide only a glimpse into the expanding frontiers of research in high resolution infrared spectroscopy. (IAA)

8195 GROWTH MECHANISM OF GRAINS IN A PRIMORDIAL STAGE OF THE SOLAR NEBULA. Carusi, A. (Univ., Rome); Coradini, A.; Federico, C.; Fulchignoni, M.; Magni, G. pp 21-35 of Exploration of the Planetary System. Woszczyk, A. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on exploration of the planetary system; Torun, Poland (5 Sep 1973).

Grain accretion processes in a protoplanetary nebula have been studied regarding the distribution function of grain velocities and the electrostatic and electromagnetic mechanisms between grains. The velocity distribution function has been investigated for grains embedded in a turbulent gaseous medium. Results have been obtained for protoplanetary nebula densities ranging from 0.0001 to 100,000 fenetograms per cu cm. Considering interactions between two grains, photoelectrically charged by galactic ultraviolet flux and by charged-particle capture, and solid-solid interactions (dipole fluctuation effect), the authors estimate the physical cross section with respect to the geometric one. A statistical approach for an assembly of grains gives the accretion or destruction rates for these small particles. (IAA)

8196 STATUS OF MOLECULAR OPACITIES OF INTEREST IN THE MODELING OF A PROTO-SOLAR NEBULA. Huebner, W. F.; Fullerton, L. W. (Los Alamos Scientific Lab., NM). pp 13-20 of Exploration of the Planetary System. Woszczyk, A. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on exploration of the planetary system; Torun, Poland (5 Sep 1973).

The report centers on general procedures applicable to the calculation of constitutive properties (equation of state and opacity) of media that serve as models for the solar nebula during planet formation and for the atmospheres of some planets. Specifically considered are the equilibrium compositions of a mixture of atoms, molecules, and their ionic species in the gaseous phase, condensation into grains with refractory cores and mantles of volatile compounds, and the "optical" properties of the grain-gas medium. A summary of available and still needed basic (input) data and some currently available results are presented. (IAA)

8197 PLANETARY FORMATION. Williams, I. P. (Queen Mary Coll., London). pp 3-12 of Exploration of the Planetary System. Woszczyk, A. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on exploration of the planetary system; Torun, Poland (5 Sep 1973).

Theories of planetary formation involving a continuous solar nebula are examined, giving attention to a large and a small nebula as part of star formation. A nebula resulting from the accretion of material is also considered. One of the main problems in theories of this type is the accumulation of small grains and gas into planets. Theories of discrete accumulation are also discussed, taking into account tidal theories and the capture of material in random orbits. (IAA)

8198 EXPLORATION OF THE PLANETARY SYSTEM. Proceedings of the Symposium, Torun, Poland, September 5–8, 1973. Woszczyk, A.; Iwaniszewski, C. (eds.). IAU Symposium, No. 65. Dordrecht, Netherlands; D. Reidel Publishing Company (1974). 577p. (In English and French). $70.56.

Papers are presented which discuss and evaluate numerous recent spectrosocpic, photometric, and polarimetric data on the planets, yielding new contributions to the knowledge of the origin and physics of the planetary system, the terrestrial planets, and the outer planets and their satellites. Some of the topics covered include the status of molecular opacities of interest in the modeling of a proto-solar nebula, radio interferometry of Venus at short wavelengths, nature of the Venus clouds as derived from their polarization, radio occultation exploration of Mars, observations of spatial and temporal variations of the Jovian hydrogen quadrupole lines, Jupiter's microwave spectrum and its implications for the upper atmosphere, the Saturnian gas-doughnut hypothesis, and observational constraints on model atmospheres for Uranus and Neptune. Individual items are announced in this issue. (IAA)

8199 INFLUENCE OF THE SURFACE BOUNDARY LAYER ON EVOLUTIONARY MODELS OF JUPITER. Graboske, H. C. Jr. (Univ. of California, Livermore). pp 337-344 of Exploration of the Planetary System. Woszczyk, A. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1974).

From conference on exploration of the planetary system; Torun, Poland (5 Sep 1973).

A recent theoretical study of the structure and evolution of Jupiter (Graboske et al., 1974b) is based on a three-stage model of Jovian evolution. The central phase, gravitational contraction of an adiabatic, homogeneous convective fluid system, begins early in solar system evolution and lasts for times of the order of 2 b.y. Good agreement with observed radius and luminosity is achieved for a model with a solar mixture composition. The surface boundary layer has a dominant influence on the evolutionary timescale. Surface boundary factors which are important are the solar energy input, a function of the solar luminosity and the planetary albedo, and the detailed physics of the superadiabatic zone, which depends on the variation of opacity and adiabatic gradient with depth. The evolutionary study demonstrates that the current planet cannot be an adiabatic homogeneous fluid throughout. The inclusion of a superadiabatic zone is necessary, and the existence of a heterogeneous (gravitationally layered) fluid interior is possible. (IAA)

8200 EXPERIMENTAL DETECTION OF THE INFLUENCE OF RADIATION DAMAGES UPON THE DIFFUSION BEHAVIOUR OF SOLAR WIND NOBLE GASES IN SINGLE GRAINS OF MOON DUST. Ducati, H. Heidelberg; Univ. Heidelberg (1973). 48p. (In German). INIS.

Thesis.

The linear heating technique was applied to study the diffusion of solar wind implanted noble gases (^{4}He and ^{20}Ne) in single grains of moon dust. The samples were heated in a diffusion oven with a heating rate of 6 K/min from room temperature to 1,200 K. The thus expelled gases were detected in highly sensitive mass spectrometer directly connected to the diffusion oven. To test the measuring method, neutron-irradiated LiF monocrystals with known ^{4}He content were subjected to the measuring procedure. The degasification pictures found or activation energies agree well with the theoretically determined degasification pictures or activation energies of other authors for the diffusion of ^{4}He in LiF. Glass spheres were mainly measured but also a few minerals. In addition, helium and neon were implanted in synthetic glass which had a composition similar to moon glass. Typical injection energies were chosen for solar wind helium and solar wind neon. The activation energies found for the diffusion of the solar wind gases on the moon samples are higher than those of the implanted gases in the synthetic glass. In order to study the influence of the radiation damage on the diffusion of He and Ne, radiation damage was induced in the synthetic glasses by high doses of ion bombardment. The diffusion of the implanted gases in these radiation-damaged glasses required an increased activation energy for a part of the gases as opposed to the diffusion of gases in the non-damaged samples. By radiation damaging of one of the glasses similar to moon glasses, energy drops can be achieved which bind the implanted gases more firmly. The considerable gas losses of light noble gases which have been determined by many authors in moon dust are explained by diffusion losses. The activation energy for normal volume diffusion is only small enough in the case of helium to allow large gas losses at moon day temperature. Losses of helium, neon and heavy noble gases are explained either by diffusion along radiation damage channels in the amorphous approximately 500 A thick surface layer of the samples, or by healing of the easily movable radiation damage (point defects). (GE)

8201 RELATION BETWEEN JUPITER'S DECAMETRIC RADIO EMISSION AND ITS ACTIVITY IN THE EQUATORIAL ZONE. Basu, D. (Univ. of Sao Paulo, Brazil); Banos, C. J. Astrophys. Lett.; 16: No. 3, 97-98(1975).

Significant correlation has been found between the peculiar optical activity in the equatorial area of the planet Jupiter and the Jovian decametric radiation at 18.0, 22.2 and 27.6 MHz. (auth)

8202 COMPARISON AND INFERRED AND OBSERVED INTERPLANETARY MAGNETIC FIELD POLARITIES, 1970–1972. Wilcox, J. M.; Svalgaard, L. (Stanford Univ., CA). J. Geophys. Res.; 80: No. 25, 3685-3688(1 Sep 1975).

The inferred polarity (toward or away from the sun) of the interplanetary magnetic field at earth using polar observations of the geomagnetic field has been compared with spacecraft observations. A list published by Svalgaard (1974) of the inferred field polarities during 1970-1972 is found to be correct on 82 percent of the days. A near real time (same day) method of inferring the polarity of the interplanetary magnetic field using geomagnetic observations at Vostok and Thule is in use at the NOAA Space Environment Laboratory, Boulder, Colorado. During 1972 this method is found to be correct on 87 percent of the days. A list of "well-defined" sector boundaries at earth during 1970-1972 is given. (auth)

8203 MODIFICATION OF PARTICLE FLUXES AT THE LUNAR SURFACE BY ELECTRIC AND MAGNETIC FIELDS. Reiff, P. H. Houston, TX; Rice Univ. (1975). 111p. University Microfilms Order No. 75-22,055.

Thesis (Ph. D.).

The access of incident plasma to the lunar surface is dependent on the electric and magnetic fields in the vicinity. The fields and fluxes are mutually dependent: the magnetic fields (local and external) gate the access of the external plasma to the surface, and the particle flux that reaches the surface affects the current balance with surface photoelectrons, which in turn determines the surface potential. As the electrons in the incident plasma are deflected more severely than the ions by the lunar fields, a charge separation layer occurs. Thus another electric field is created to equalize the penetrating fluxes of electrons and protons. The deflection of the incident protons and electrons in opposite ways creates a current that changes the local magnetic field slightly. A complete self-consistent theoretical model of fields and fluxes is dependent on a number of factors (electron and proton temperatures and densities, plasma flow velocity, external magnetic field orientation and magnitude, and the characteristics of any local fields) and is beyond the scope of this thesis. This thesis calculates open and shadow zones for the access of incident particles to the surface as a function of the external magnetic-field direction, both for the case of no local magnetic field and for the large local magnetic field estimated at the Apollo 14 ASLEP site. Predictions are made for the variation of the magnitude of the charge-separation electric field with variable external plasma and field conditions. These open and shadow zones and their effect on the surface potential are tested and confirmed with particle data from the Apollo 14 CPLEE plasma analyzer and magnetic-field data from Explorer 35 in lunar orbit. (Diss. Abstr. Int., B)

8204 DYNAMICS OF INTERPLANETARY DUST GRAINS. Lamy, P. L. Ithaca, NY; Cornell Univ. (1975). 333p. University Microfilms Order No. 75-21,564.

Thesis (Ph. D.).

The interaction of spherical grains of various materials–three silicates (quartz, obsidian and andesite), water-ice and iron–whose radii lie in the micronic and submicronic range with the interplanetary medium is solved. This includes: the interaction with the solar radiation field which is solved using Mie scattering theory and taking into account the precise dependence of the optical properties of the five materials upon wavelength; the interaction with the solar wind: corpuscular tangential drag is found to be always important and may even be larger than the Poynting-Robertson drag; the interaction with the interplanetary magnetic field is investigated in terms of a diffusion or random walk through a series of electromagnetic scatterings, leading to a Chapman-Komolgorov equation (i.e., a generalized Liouville equation). Numerical results are presented for these interactions spanning the entire solar system with circularity of elliptical orbits, direct or retrograde, with grains of various materials and sizes and giving–probably for the first time–a clear global picture of the interaction of dust grains with the interplanetary medium. The dynamics of the grains is then investigated using the theory of general perturbations and the numerical integration of trajectories of circumsolar grains. (Diss. Abstr. Int., B)

8205 SOME BASALTIC AND ANDESITIC GASES. Anderson, A. T. (Univ. of Chicago). Rev. Geophys. Space Phys.; 13: No. 1, 37-55(Feb 1975).

Data (mostly post-1963) on H_2O, B, CO_2, N_2, O_2, Ne, sulfur gases, Cl, ^{38}Ar, ^{40}Ar, Br, Kr, I, Xe, Hg, and Rn is reviewed. The compositions of volcanic gases are compatible with solubility and melt composition for H_2O, Cl, and possibly sulfur gases. For other gases there are either inadequate data or conflicting data (CO_2). Glassy basalts from the sea floor have substantial concentrations of both active and noble gases. It appears likely that magmatic gas of basalts at sea floor pressure is 60 percent SO_2, 20 percent H_2O, 10 percent H_2S, and 10 percent CO_2 at 1200°C. The concentrations of Cl and H_2O in basaltic and andesitic gases trapped in large crystals in pumices from continental margins are about 10 times those of deep sea basalts. Detailed relationships suggest that at least some andesitic magmas develop in vapor-saturated environments. The restored or potential concentrations of H_2O and Cl in andesitic magmas is estimated by allowing for vapor loss during production of andesite from a basaltic precursor. The restored concentrations are used as a basis for estimating the rate of igneous outgassing in island arcs and continental margins. The inferred rates of outgassing are such that the present quantities of gaseous elements in seawater and sediment would be exhaled in 10^9 to 10^{10} years for H_2O, Cl, Br, S, I, and Hg. The rates of outgassing of CO_2 from Kilauea volcano and of SO_2 from Pacaya exceed the rate which could be maintained by outgassing of erupted lava. These relations imply the existence of a larger source of these gases than that of the volcanic rocks. Apparently, large subsurface reservoirs of melt discharge gas out of the volcanic vents. It seems probable that volcanic rocks are generally volumetrically small portions of subsurface reservoirs which may be vapor-saturated. Such a condition has major implications for crustal evolution, the origins of volcanic rocks, eruption mechanisms, and hydrothermal ore deposits. (auth)

8206 IONOSPHERE OF VENUS. Butler, D. M. Houston, TX; Rice Univ. (1975). 263p. University Microfilms Order No. 75-21,999.

Thesis (Ph. D.).

The Venus dayside ionosphere is modeled including both photochemistry and vertical diffusion in our calculations. The basic neutral atmosphere and temperature structure are obtained from models by Dickinson and Ridley, augmented by calculations. Efforts are concentrated on a comprehensive study of the ion chemistry and diffusion processes and approximations for ion and electron temperature structure are used. The model accurately reproduces the location of the electron density peaks observed, and it is shown that large mixing ratios of He are not required to explain the Mariner V observations between 250 and 475 km. The effects of solar zenith angle and temperature are examined in trying to explain Mariner X results. It is concluded that the solar wind or some other mechanism outside the scope of our models must be considered in the region above the principal electron layer. A model of the nightside ionosphere which does not require a large abundance of light reactive ions is proposed. (Diss. Abstr. Int., B)

8207 JUPITER'S RADIATION BELTS AND THEIR EFFECTS ON SPACECRAFT. Parker, R. H.; Divita, E. L.; Gigas, G. (California Inst. of Tech., Pasadena). pp 93-133 of Evaluation of the Effect of the Space Environment on Materials. Paris; Centre National d'Etudes Spatiales (1974).

From conference on evaluation of the effect of the space environment on materials; Toulouse, France (17 Jun 1974).

The effects of electron and proton radiation on spacecraft which will operate in the trapped radiation belts of the planet Jupiter are considered, and the techniques and results of the testing and simulation used in the radiation effects program at the Jet Propulsion Laboratory are discussed. Available data from the Pioneer 10 encounter of Jupiter are compared with pre-encounter models of the Jupiter radiation belts. The implications that the measured Jovian radiation belts have for future missions are considered. (auth)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstracts 8080 and 8084.

8208 (BMFT-FB-W-75-10) DENSITY AND DENSITY VARIATION FOR THE EXOSPHERE CALCULATED FROM ORBITAL PERTURBATIONS OF THE ECHO I SATELLITE. Witt, N. (Bundesministerium fuer Forschung und Technologie, Bonn (F. R. Germany)). Jun 1975. 123p. (In German). INIS.

With figs.; 6 tabs.; 66 refs.

An objective, reproducible method was employed to approximate the mean anomaly residuals. The effect of earth albedo and solar radiation pressure on the orbital motion were taken into account. In the examined height range of 900 to 1,050 km dragdeduced densities were found to be consistently lower than was to be expected from the 1971 static diffusion model (Jacchia, 1971), especially at solar minimum. The densities show a positive correlation with solar 10.7 cm flux. Six magnetic storm events were analyzed in detail to determine the course and response time of exospheric density variations with respect to geomagnetic fluctuations. In all cases increased geomagnetic activity was found to correspond to increases in density. (GE)

8209 (N-75-12473) STUDIES OF THE AIRGLOW, THE AURORA, THE ION AND NEUTRAL COMPOSITION, AND THE CHEMISTRY OF THE TERRESTRIAL ATMOSPHERE. Zipf, E. C. Jr. (Pittsburgh Univ., Pa. (USA). Dept. of Physics). 30 Sep 1974. 30p. (NASA-CR-140960). NTIS $3.75.

Results obtained by rocket-borne optical spectrometry are presented. Composition measurements and auroral studies are reported. The production of N (D-2) atoms by photo-absorption processes, and by electron impact excitation of N2 are discussed along with vibrationally excited CO2(+) ions in planetary atmospheres. (STAR)

8210 SOLAR FLARES AND D-REGION IONIZATION SOURCES AT HIGH ZENITH ANGLES. Gough, M. P. (Mackenzie Univ., Sao Paulo, Brazil). pp 108-113 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

VLF phase measurements were made at three locations along the same great circle path of propagation during a solar flare which occurred on June 29, 1973. The termination for the solar flare effect on the ionosphere at VLF reflecting heights occurred between solar zenith angles 84 and 87 deg, considerably less than the sunset zenith angle of 94 deg for this height. Ionization production is considered for the various ionization sources as a function of zenith angle. The measurement is consistent with the electron density at VLF reflecting heights, being primarily controlled by solar photodetachment, but at zenith angles greater than 76 deg, the ionization available for photodetachment, is produced by scattered Lyman-alpha as the direct Lyman-alpha becomes too heavily absorbed. (auth)

8211 ELECTRON PRODUCTION IN THE LOWER IONOSPHERE BY A DIFFUSE GALACTIC X RAY BACKGROUND AND SOME MAJOR X RAY SOURCES. Gagliardini, D. A.; Karszenbaum, H. (Univ. Nacional, La Plata). pp 99-107 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

8212 SOLAR X-RAY CONTROL OF THE D-REGION OF THE IONOSPHERE. Sengupta, P. R. (Inst. of Applied Manpower Research, New Delhi). pp 75-98 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

The contribution of non-flare solar X-rays to the ionization in the D-region in the nonpolar latitudes has been evaluated on the basis of an X-ray emission model derived previously by the author (1971). It is shown that experimentally observed variation of D-region electron density profile with solar activity as well as the variation with solar activity of 2.44-MHz vertical incidence absorption over Freiburg is fully explained in the light of the author's solar X-ray emission model. After detailed analysis it is concluded that the variation of the D-region parameter with solar activity over a period extending from solar minimum to solar maximum is primarily due to X-ray emission from the solar coronal active regions. The contribution of solar X-rays to the ionization in the D-region depends on the solar activity level. (IAA)

8213 PHOTONUCLEAR MECHANISM FOR PROMETHIUM SYNTHESIS EXCLUDING TECHNETIUM. Harrison, T. G. (North Texas State Univ., Denton). Astrophys. Lett.; 16: No. 3, 87-95 (1975).

It is shown where $^{13}C(p,\gamma)^{14}N$ photons are able to trigger the photoneutron reaction $^{146}Nd(\gamma,n)^{147}Nd(\beta^-)^{147}Pm$ leading to a synthesis of ^{147}Pm, but are not able to trigger the equivalent reaction leading to the synthesis of ^{99}Tc via $^{100}Mo(\gamma,n)^{99}Mo(\beta^-)^{99}Tc$. Thus, depending upon the magnitude of a presently unknown photoneutron cross section, this scheme is presented as a means whereby ^{147}Pm is routinely manufactured during CNO burning, but where also, due to differences in the neutron binding energy, the analogous synthesis of all technetium isotopes is discriminated against. Transit time between shell and surface for irradiated material is considered and found to be of little consequence in causing a weakening of atmospheric promethium. Envelope dilution is the dominant factor in determining the detectability of atmospheric promethium, and we find that the probability for its detection in the atmosphere of a star manufacturing promethium in a shell region is reasonably good to marginal, depending upon interior conditions. (auth)

8214 AUGER-PROCESSES IN THE IONOSPHERE. Avakian, S. V.; Vlasov, M. N. (Hydrometeorological Bureau, Moscow). pp 191-199 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

Data are presented comparing the production rate of Auger electrons with that of usual photoelectrons in the ionosphere. Analysis of the behavior of ionization cross sections of main atmospheric constituents reveals a sharp increase at the Auger threshold. A formula is given for determining the probability of Auger-electron production at different heights for a given X-ray flux if ionization cross sections are known. (IAA)

8215 WORLDWIDE DISTRIBUTION OF THE SPECTRAL COMPONENTS OF f_0F2 AND THEIR DEPENDENCE ON THE SOLAR CYCLE AND THE EARTH'S MAGNETIC FIELD. Paul, A. K.; Laird, A. R. (Space Environment Lab., Boulder, CO). pp 209-219 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

8216 IONOSPHERIC S-SHAPED DOPPLER FLUCTUATIONS PRODUCED BY THE TORNADOES. Hung, R. J. (Univ. of Alabama, Huntsville); Rao, G. L.; Smith, R. E. pp 479-488 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

A three-dimensional nine element HF-CW Doppler sounder array has been used to detect ionospheric disturbances which may be due to tornadoes. The typical events chosen in the present study occurred on November 20 and 27, 1973. Both events are apparently associated with tornadoes sighted in the Huntsville, Alabama area. The Doppler records show S-shaped waves rather than the quasi-simusoidal waves observed in conjunction with and apparently due to thunderstorms. The wave-periods are in the range of 6 to 8 minutes instead of the 3 to 5 minute periods associated with thunderstorms. Dissipation of waves is mostly due to the evanescent effect and they cannot propagate very far from the path of the tornado center. A theory is presented which is in good agreement with the observations. (auth)

8217 PROBABLE EFFECTS OF ELECTRON PRECIPITATION IN THE LOWER IONOSPHERE IN THE AREA OF THE SOUTH ATLANTIC ANOMALY. Franco, R. J.; Gagliardini, D. A.; Radicella, S.; Restbergs, V. (Univ. Nacional, La Plata). pp 168-177 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

8218 SOLAR PROTONS AT LOW LATITUDES ON LF REFLECTORS. Naidu, J. V. M.; Rao, B. R. (Andhra Univ., Waltair, India). pp 159-167 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

Amplitude of 292-kHz signals reflected at low-latitude lower-ionospheric heights is found to increase to abnormally high values during the day time in the period June 7 to 11, 1972, which happens to be a solar proton event period. The energy spectrum of solar cosmic rays for this period shows an increase of flux in the energy range 10 to 60 MeV as measured from the Explorer-41 observations. The observed effect is explained on the basis of an increase in ionization through the D-region heights caused by 10-60 MeV solar protons. The nature of fading observed during this period also supports the idea that the effect is due to corpuscular radiation. As the direct impact of protons in releasing ion pairs would need higher energies for their penetration to lower regions at low latitudes, it is suggested that a new and different mechanism might have been responsible for the penetration of the lower energy protons down to the D-region heights. (auth)

8219 NIGHT TIME IONIZATION BY PARTICLE PRECIPITATION IN THE SOUTH ATLANTIC GEOMAGNETIC ANOMALY. Abdu, M. A.; Rai, D. B. (Instituto de Pesquisas Espaciais, San Jose dos Campos, Brazil). pp 178-188 of International Symposium on Solar-Terrestrial Physics. Vol. 3. Sao Jose dos Campos, Brazil; Instituto de Pesquisas Espaciais (1974).

From proceedings of international symposium on solar-terrestrial physics; Sao Paulo, Brazil (17 Jun 1974).

8220 VOLCANIC DUST, SUNSPOTS, AND TEMPERATURE TRENDS. Schneider, S. H. (National Center for Atmospheric Research, Boulder, CO); Mass, C. Science; 190; No. 4216, 741-746(21 Nov 1975).

The extent to which two often proposed external causes of climatic change, volcanic dust and variations in the solar constant correlated with variable sunspot activity, might account for the general patterns of surface temperature variation since A. D. 1600 are examined. The consequences of a simple climatic model are discussed. (32 references) (BJG)

8221 STUDY OF THE ELECTRICAL CONDUCTIVITY OF AIR IN THE LOWER STRATOSPHERE OVER POONA. Huddar, B. B.; Joseph, C. P.; Mani, A. pp 110-118 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 1. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition, and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

Regular soundings to measure the electrical conductivity of air over Poona have been made since 1969, using balloon-borne conductivity sondes. Some of the earlier soundings had shown a sharp decrease in conductivity above 18 km, and this had been attributed to the presence of stratospheric dust at this height. Associated increase in electrical potential gradient had been also observed. The present systematic soundings show that the variation of conductivity with height agrees with theoretical values during May to September, while during the months October to March it shows a sharp fall after about 18 km. The main cause for the observed variations in conductivity would appear to be the changes in aerosol content caused by changes in the circulation patterns in the lower stratosphere. (auth)

8222 MECHANISM OF FORMATION OF STRATOSPHERIC AEROSOLS. Leifer, R. (New York Polytechnic Inst., Brooklyn); Friend, J. P.; Trichon, M. pp 128-143 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 1. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

A model is presented for the formation of stratospheric aerosols. Experiments are described, in which trace quantities of SO_2, NH_3, O_3, and H_2O were irradiated for various time periods and in different wavelengths intervals. The role of NH_3 in ammonium sulfate formation is discussed, and it is shown that coagulation of sulfuric acid embryos to some critical size is necessary before rapid growth by heteromolecular oxidation can occur. The experimental results show that the quantum yield of homogeneous oxidation of SO_2 by O_2 in the first strong band is less than 1.0 times 10 to the minus 10th power, that formation and stability of acid embryos are highly dependent on the available water vapor concentration, and that the concepts of equilibrium thermodynamics do not provide realistic estimates of heteromolecular nucleation rates. (IAA)

8223 HYDROGEN AND CARBON COMPOUNDS IN THE UPPER STRATOSPHERE AND LOWER MESOSPHERE. Martell, E. A.; Ehhalt, D. H. (National Center for Atmospheric Research, Boulder, CO). pp 223-229 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 1. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

The rocketborne cryogenic air sampling technique and results from two sampling flights are summarized. The operational principles and experimental applications of the cryogenic sampler are outlined, and four flights (two of which aborted) are described. The results of the first flight, which used liquid hydrogen and collected 9.73 moles of air, are briefly noted and tabulated. The results of the last flight, which used liquid neon and collected an 11.3-mole air sample in the upper stratosphere between 40 and 50 km altitude, are tabulated, and analysis of the trace gas concentrations is discussed. (IAA)

8224 PLANETARY DISTRIBUTIONS OF ^{210}Pb AND ^{210}Po CONTENT IN THE LOWER STRATOSPHERE AND THEIR USE FOR THE ESTIMATION OF TRANSPORT PARAMETERS. Karol, I. L. (Geophysics Observatory, Leningrad). pp 1255-1264 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 2. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne Australia (14 Jan 1974).

The published results of aircraft measurements of radioactive isotope ^{210}Pb and ^{210}Po concentrations in the stratosphere over the Western Hemisphere up to 20-km level in 1967-1971 are systematized and analyzed. The study of their seasonal and latitudinal variations at different levels makes is possible to estimate the effective "age" of stratospheric aerosols and to find out that the troposhperic air enters into the lower stratosphere mainly in summer in the northern temperate and tropical latitudes. The interannual variation of stratosphere-troposphere exchange intensity in the Northern Hemisphere is considered as based on the "age" of stratospheric aerosols. This exchange intensity variation leads to the variation of stratospheric sulphate aerosol content according to measurements in the northern temperature latitudes in 1960-1971. The method of estimation is suggested and results are presented for mean seasonal parameters of vertical transport in the northern temperate latitudes based on the ^{210}Pb and ^{210}Po data mentioned. These parameters are related to the model of global aerosol transport in the lower stratosphere. (auth)

8225 NIGHTGLOW AND DYNAMICS OF THE UPPER ATMOSPHERE. Kulkarni, R. N. (Commonwealth Scientific and Industrial Research Organization, Victoria, Australia). pp 517-524 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 2. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

The investigation reported involved the conduction of ground-based measurements of night airglow at a wavelength of 5577 A. Studies of night airglow which originate at an altitude of about 95 km are important in an investigation of the physics and the dynamics of the mesosphere. Diurnal intensity variations are discussed along with seasonal intensity variations and calculations of vertical transport. A definite relationship is found between the intensity variations and the dynamics at the base of the thermosphere both on diurnal and seasonal time scales. (IAA)

8226 WINDS AND WAVE MOTIONS UP TO 110 km AT MID-LATITUDE. Manson, A. H.; Gregory, J. B.; Stephenson, D. G. (Saskatchewan Univ., Saskatoon). pp 593-603 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 2. Derco, N. J. (ed.). Downsview, Ont.;

International Association of Meterology and Atmospheric Physics (1974).

From conference on structure, composition and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

Measurements of winds (60-110 km) for Sakatoon, Canada, have been obtained from a partial reflection radiowave system. Closely spaced atmospheric soundings (12 per hour) for heights between 51-117 km with 3-km height resolution, were made between August 1972 and September 1973. The median of the wind profiles for a given hour has been identified mainly as the prevailing wind, and the irregular components from each profile as internal atmospheric gravity waves. The amplitudes and shears of the irregular winds have their largest values in winter. A diurnal variation has been found, showing a minimum in amplitude and shear values near noon for all seasons; this variation is especially noticeable above 90 km. Comparisons of seasonal variations in the prevailing zonal and meridional winds, with the amplitudes of the irregular winds, suggest interactions involving critical layers and momentum transfer. (auth)

8227 UPPER ATMOSPHERE WINDS BY RADIO TECHNIQUES. Briggs, B. H.; Stubbs, T. J.; Vincent R. A. (Adelaide Univ.). pp 614-623 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 2. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

Reflections of radio waves from weak irregularities of ionization in the D region of the ionosphere can be observed over the height range 60 to 100 km. Observations of the fading of these waves made at spaced aerials can be used to obtain the horizontal motion of the atmosphere in this height interval. In the present paper observations made at Adelaide and at Woomera by this technique are reported. The results show clear evidence of prevailing winds and strong tidal components, as well as evidence for shorter period velocity fluctuations. Comparisons with drifts of meteor trails observed at Adelaide show good agreement. Comparisons with winds observed at Woomera by rocket techniques have also been made. Although this aspect of the work is at an early stage of development, encouraging evidence of agreement has already been found. It is concluded that the radio wave sounding technique provides a valuable and relatively inexpensive method for obtaining continuous observations of horizontal atmospheric winds, tides, and wave phenomena in the height range 60-100 km. (auth)

8228 6-YEAR SYNOPTIC STUDY OF WINDS BETWEEN 80 AND 100 km, FROM METEOR TRAIL DRIFTS. Elford, W. G. (Adelaide Univ.). pp 624-641 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 2. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition, and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

8229 ATMOSPHERIC RESPONSE TO THE QUASI-RESONANT GROWTH OF FORCED PLANETARY WAVES. Clark, J. H. E. (Univ. of Texas, Austin). pp 777-808 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 2. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition, and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

The forcing of the second-order zonally-averaged wind and temperature fields due to the quasi-resonant growth of planetary waves in a two-layer model is considered. Dissipation in the form of linear drag and Newtonian cooling is allowed for. Calculations are made in a mid-latitude β-plane channel bounded by two vertical walls. The linear or first-order solution is constrained so as to not transport momentum meridionally. Three neutral modes in the adiabatic two-layer model are brought to resonance separately by adjusting the basic zonal flow configuration. For a dissipation time scale of 3 days, the quasi-resonant enhancement of the response is negligible. A time scale of 6 days is thus used. For resonance involving the two-layer equivalent of the Rossby wave, the strong westerly zonal flow configuration causes most of the second-order effects to be confirmed to the lowest few scale heights, where a slow easterly acceleration of the zonal flow occurs. A second resonance associated with weak westerlies surmounted by moderate westerlies leads to a very rapid high-level easterly acceleration lasting about two weeks. A final resonant wind configuration with easterlies above westerlies is associated with very rapid temperature rises near the pole. (auth)

8230 NORTHERN HEMISPHERIC ANALYSIS METHODS FOR DERIVING TWO-DIMENSIONAL TRANSPORT MODEL OF TROPOSPHERE AND STRATOSPHERE FROM ISENTROPIC TRAJECTORIES AND POTENTIAL VORTICITY. Danielsen, E. F.; Deaven, D. G. (National Center for Atmospheric Research, Boulder, CO). pp 835-848 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 2. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition, and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

8231 DIURNAL KINETIC MODELING. Gelinas, R. J. (Univ. of California, Livermore). pp 849-868 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 2. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition, and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

The present paper considers dynamic-kinetic models of the stratosphere which include diurnal variations. The basic theory underlying atmospheric trace-gas evolution is discussed briefly. The limits of physical and mechanistic interpretability are examined for constant-flux and diurnal models in zero and one spatial dimension. It is shown that highly approximated time-dependent diurnal calculations can serve important purposes. A zero-dimensional diurnal kinetic model is described and diurnal calculations are carried out with it. The numerical aspects of solving diurnal kinetic equations are discussed. Three different reaction sets of varying complexity are considered for an altitude of 20 km (217 K), where both transport and kinetic effects are operative. (IAA)

8232 SEASONAL AND LATITUDINAL VARIATIONS OF N_2O AND NO_x IN THE STRATOSPHERE. Vupputuri, R. K. R. (Atmospheric Environment Service, Toronto). pp 881-904 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 2. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition, and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

Based on their currently known sources and sinks, the seasonal and latitudinal behavior of N_2O, NO, NO_2, and HNO_3 in the stratosphere is studied, using a two-dimensional model that takes into account both horizontal and vertical transport processes and photochemical processes. It is shown that such parameterized transports as large-scale eddy effects and mean meridional motions, which affect photochemical production and loss processes through redistribution, play a significant part in the maintenance of the absolute summer and winter concentrations of N_2O, NO, and NO_2 in all regions, except in the summer upper stratosphere. It is found that NO is predominant in the upper stratosphere, $NO + NO_2$ in the middle layer, and HNO_3 in the lower stratosphere. (IAA)

8233 RECENT ADVANCES IN SATELLITE OBSERVATIONS OF SOLAR VARIABILITY AND GLOBAL ATMOSPHERIC OZONE. Heath, D. F. (Goddard Space Flight Center, Greenbelt, MD). pp 1267-1291 of International Conference on Structure, Composition, and General Circulation of the Upper and Lower Atmospheres and Possible Anthropogenic Perturbations. Volume 2. Derco, N. J. (ed.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974).

From conference on structure, composition, and general circulation of the upper and lower atmospheres and possible anthropogenic perturbations; Melbourne, Australia (14 Jan 1974).

A description is given of the temporal behavior of the sun as an ultraviolet variable star in relation to daily zonal means of atmospheric ozone from the total amount to that above the 10-mb and 4-mb pressure levels. A significant correlation has been observed between enhancements in the ultraviolet solar irradiances and terrestrial passages of the solar magnetic field sector boundary structure. However, it has not yet been possible to separate solar from the dynamical effects on the variability in

the zonal means of ozone. Attention is given to global changes in ozone which have been derived from the satellite observations in terms of season, solar variability, and major stratospheric disturbances such as stratospheric warmings. (IAA)

8234 INTERNATIONAL CONFERENCE ON STRUCTURE, COMPOSITION, AND GENERAL CIRCULATION OF THE UPPER AND LOWER ATMOSPHERES AND POSSIBLE ANTHROPOGENIC PERTURBATIONS. Volume 1. Conference Held at Melbourne, Australia, January 14–25, 1974. Derco, N. J.; Truhlar, E. J. (eds.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974). 519p.

Theoretical and experimental studies on the dynamics of aerosols in the atmosphere and on ozone chemistry are presented, with a view toward assessing the effects of global pollution. Some of the topics covered include the present worldwide distribution of stratospheric aerosols, new aspects of CO and H_2 cycles in the atmosphere, stratospheric water vapor distribution and variability a comparison of the Southern and Northern Hemisphere general circulation characteristics as determined by satellite ozone data, non-photochemical processes of ozone formation and destruction in the lower atmosphere, and increase of carcinogenic ultraviolet radiation due to reduction in ozone concentration in the atmosphere. (IAA)

8235 INTERNATIONAL CONFERENCE ON STRUCTURE, COMPOSITION, AND GENERAL CIRCULATION OF THE UPPER AND LOWER ATMOSPHERES AND POSSIBLE ANTHROPOGENIC PERTURBATIONS. Volume 2. Conference Held at Melbourne, Australia, January 14–25, 1974. Derco, N. J.; Truhlar, E. J. (eds.). Downsview, Ont.; International Association of Meteorology and Atmospheric Physics (1974). 782p.

Theoretical and experimental studies on the dynamics of aerosols in the atmosphere and on ozone chemistry are presented, with a view toward assessing the effects of global pollution. Some of the topics covered include the present worldwide distribution of stratospheric aerosols, new aspects of CO and H_2 cycles in the atmosphere, stratospheric water vapor distribution and variability, a comparison of the Southern and Northern Hemisphere general circulation characteristics as determined by satellite ozone data, non-photochemical processes of ozone formation and destruction in the lower atmosphere, and increase of carcinogenic ultraviolet radiation due to reduction in ozone concentration in the atmosphere. (IAA)

8236 ENERGY SPECTRUM OF HADRONS IN COSMIC RAYS AT SEA LEVEL. Ashton, F.; Saleh, A. J. (Durham Univ., Eng.). Nature (London); 256: No. 5516, 387-388(31 Jul 1975).

Reference is made to Baruch (Nature 242: 6 (1973)) who measured the energy spectrum of hadrons (nucleons and pions) in cosmic rays at sea level and found evidence for anomalous behavior in the energy range 2 to 8 TeV. For $E < 2$ TeV Baruch found that the differential vertical intensity decreased with increasing energy, while for $2 < E < 8$ TeV the intensity was almost constant, and for $E > 8$ TeV the intensity again decreased with increasing energy. It was proposed that this was due to the interaction of a new particle, of rest mass 40 to 70 GeV c^{-2}, mean lifetime $> 2 \times 10^{-7}$ sec., and an interaction length of about 1000 gcm^{-2}. New measurements are here described on the hadron spectrum at the highest energies. Details are given of the apparatus used and its mode of operation. The results showed no evidence for transitions in the energy range 2 to 8 TeV, and were consistent with a spectrum of the form $E^{-2.7\pm0.1}$ over the whole energy range from 10 GeV to 10 TeV, but there could have been an irregularity in the form of the spectrum which escaped detection, although this is considered improbable. (UK)

8237 SATELLITE MEASUREMENTS OF NITRIC OXIDE IN THE POLAR REGION. Rusch, D. W. (Univ. of Michigan, Ann Arbor); Barth, C. A. J. Geophys. Res.; 80: No. 25, 3719-3721 (1 Sep 1975).

Ultraviolet measurements of the (1,0) gamma band of nitric oxide in fluorescence by a satellite at high latitudes show nitric oxide concentrations which are highly variable in both time and space. The average nitric oxide concentration is 3–4 times higher at high latitudes than at mid-latitudes. If auroral activity is responsible for the larger nitric oxide densities and if the reaction $N(^2D) + O_2$ is the source of NO, then auroral processes must be more efficient in the production of $N(^2D)$ atoms than dayglow processes. (auth)

8238 SEMIANNUAL VARIATIONS IN THE MESOSPHERE. Ganguly, S. (Inst. of Radiophysics and Electronics, Calcutta). J. Geophys. Res.; 80: No. 25, 3722-3724(1 Sep 1975).

Radio wave absorption data for a large number of stations have been used to study the semiannual variations (SAV's) in the mesosphere. Temperature data for 50-km levels have also been utilized for a similar study. While the temperature data show a systematic variation for all latitudes investigated, the absorption data do not yield a systematic phase relationship with latitude. However, the maximum SAV is found to occur at the high-latitude station. The different behavior of SAV's with latitude could perhaps be explained in terms of mesospheric composition changes resulting from a SAV in the circulation pattern of the lower atmosphere. (auth)

8239 LABORATORY MEASUREMENTS OF THE IONOSPHERIC $O_2^+(X^2Pi/sub\ g/)$ AND $O_2^+(alpha^4PI/sub\ u/)$ REACTIONS WITH NO. Lindinger, W.; Albritton, D. L.; Fehsenfeld, F. C.; Ferguson, E. E. (NOAA Environmental Research Labs., Boulder, CO). J. Geophys. Res.; 80: No. 25, 3725-3726(1 Sep 1975).

Laboratory measurements of $O_2^+(X^2PI/sub\ g/)$ and $O_2^+(alpha^4PI/sub\ u/)$ in charge transfer with NO have been carried out from 300^0K to approximately 1 eV relative kinetic energy. The 300^0K rate constants are $4.4 \pm 0.5 \times 10^{-10}$ $cm^3\ s^{-1}$ and $11 \pm 3 \times 10^{-10}$ $cm^3\ s^{-1}$, respectively. Most earlier measurements of O_2^+-NO charge transfer involved an unknown mixture of ion states and yielded values too high to be appropriate to the ionospheric E region. (auth)

8240 EXOSPHERIC TEMPERATURE INFERRED FROM THE AEROS-A NEUTRAL COMPOSITION MEASUREMENT. Chandra, S.; Spencer, N. W. (Goddard Space Flight Center, Greenbelt, MD). J. Geophys. Res.; 80: No. 25, 3615-3621(1 Sep 1975).

The derivation of exospheric temperature from satellite drag measurements is based on an assumption of invariant conditions of the neutral atmosphere at 120 km. Since it has been established that atomic oxygen, which is usually the major neutral constituent in the region of drag measurements, is subject to considerable variability with season, latitude, and solar and geomagnetic activity in the altitude region of 120 km, its value as an indicator of exospheric temperature is questionable. Ogo 6 neutral mass spectrometer measurements revealed that molecular nitrogen is a better indicator of exospheric temperature, since it is not subject to changes caused by eddy mixing and is therefore relatively less variable near the turbopause. However, theoretical arguments show that argon, even though it is a minor constituent, is relatively less variable with respect to changes in eddy diffusion coefficient and hence a better indicator of exospheric temperature than O and N_2. In this paper the relative merits of these gases for deriving exospheric temperature are investigated by using observational data from the Aeros-A Nate experiment. It is shown that the temperatures derived from Ar and N_2 are very close to each other and show very similar seasonal, latitudinal, and day to night variations under both quiet and moderately disturbed conditions. (auth)

8241 OBSERVATION OF O_3 VARIABILITY AT MID-LATITUDES FROM 1450-A MEASUREMENTS. Weeks, L. H. (Air Force Cambridge Research Labs., Bedford, MA). J. Geophys. Res.; 80: No. 25, 3661-3666(1 Sep 1975).

Measurements of molecular oxygen obtained from 1450-A absorption data are discussed. Simultaneous observations with independent sensors indicate low random errors in the technique, and systematic errors are also estimated to be low. A survey of spring-fall data at middle and low latitudes during quiet geomagnetic conditions shows an average density variability, including systematic differences in the various techniques, of up to about a factor of 2 from 135 to 180 km. At the higher altitudes the Cira (1972) mean and Jacchia 1971 models tend to overestimate the densities. Data obtained during a moderate geomagnetic disturbance show density enhancements of a factor of 2.5 from 140 to at least 180 km, relative to a typical quiet profile. Although there is more pronounced wave structure in the enhanced profile, no significant changes in the mean scale heights or temperatures are seen. The Jacchia 1971 model does not adequately account for the molecular oxygen density increases during geomagnetic disturbances. (auth)

8242 STRUCTURE AND DYNAMICS OF IONIZATION AND AURORAL LUMINOSITY DURING THE AURORAL EVENTS OF MARCH 16, 1972, NEAR CHATANIKA, ALASKA. Hunsucker, R. D. (Univ. of Alaska, Fairbanks); Romick, G. J.; Ecklund, W. L.; Greenwald, R. A.; Balsley, B. B.; Tsunoda, R. T. Radio Sci.; 10: No. 8-9, 813-821(1975).

During the period 1000–1030 UT on March 16, 1972, a very dynamic auroral event occurred in the latitudinal region from College to Fort Yukon, Alaska. Simultaneous observations of this auroral event were made with an all-sky camera, a geomagnetic meridian scanning photometer, an incoherent scatter radar, a three-component magnetometer, a 30-MHz riometer, and two VHF/UHF auroral radars. The basic purpose of this report is to illustrate the advantages of such coordinated measurements and the possibilities for future experiments. These preliminary results point out many relationships which, although not hitherto unknown, are important to the understanding of the auroral ionosphere. Paramount among these are (1) intense discrete auroral forms (greater than 25 kR in 4278 A) are associated with enhanced E-

layer electron densities near 10^6 electrons/cm^3; (2) the riometer data and the height of maximum N/sub e/ from the incoherent scatter radar suggest that few energetic (greater than 40 keV) particles were precipitating during this event; (3) enhanced regions of VHF backscatter seem to be associated with eastward and westward electrojet current systems but do not spatially correspond to the regions of high N/sub e/ or bright auroral forms; and (4) the collective data yield a description which indicates that this period is associated with the Harang discontinuity region of the auroral current systems. (auth)

8243 SOME EARLY RESULTS FROM THE ATS-6 RADIO BEACON EXPERIMENT. Davies, K.; Fritz, R. B.; Grubb, R. N.; Jones, J. E. (Space Environment Lab., Boulder, CO). Radio Sci.; 10: No. 8-9, 785-799(1975).

The multifrequency satellite radio beacon enables the measurement of the columnar electron content of the ionosphere and plasmasphere along the ray path and its spatial and temporal structure. Measurements include modulation phase, Faraday rotation, and amplitude. The characteristics of the beacon transmitter and its design are presented together with the design of the Boulder receiver and antennas and the calibration procedures. A shape factor F is defined which depends on the electron density and geomagnetic field distributions. It is found that F varies by about 30 percent from day to night. It is shown that the ratio of the plasmaspheric content to total content varies from about 0.08 during the day to about 0.35 at night. Other examples which are presented to illustrate the uses of the radio beacon include sunrise effects, solar flare enhancements of total content, and the ionospheric storms of early July 1974. (auth)

8244 IONOSPHERIC DISTURBANCES AND GRAVITY WAVES. Eun, H. J. Brooklyn; Polytechnic Inst. of New York (1975). 181p. University Microfilms Order No. 75-21,361.

Thesis (Ph. D.).

In Part I, TIDs are studied by utilizing the set of hydrodynamic equations for electrons, ions and neutrals as well as Maxwell's equations. Equations are grouped into two sets, one describing the motion of charged particles, the other describing that of neutrals. Study here is concerned with the solution of the set of equations for charged particles for the density perturbations of electrons and ions, with coupling terms between neutrals and charged particles on the right hand sides of equations. The solution thus obtained is compared with that based on a diffusion theory. Despite the analytical similarity between the results of two theories, theory presented here, being a dynamical and self-consistent one, provides some important modifications in the treatment of coupling problem between neutrals and charged particles. In Part II, an analytical attempt is made to interpret the multiple traces on an ionogram obtained by a ground sounding for irregularity information. A mathematical expression for the physical process, which returning echoes must satisfy, is sought. This expression is properly manipulated to determine the initial angle of propagation for a returning echo as a function of the horizontal perturbation parameter, alpha, and x/sub m/, position of center of the maximum perturbation. It is then possible to construct an ionogram theoretically with the aid of ray equation, with alpha and x/sub m/ as the running variables. Comparison of this theoretically constructed ionogram with the one obtained by observation permits one to determine not only the magnitude of perturbation, alpha, but also irregularity velocity. (Diss. Abstr. Int., B)

8245 BIRKELAND CURRENT FLOW IN A STRUCTURED AURORAL ARC. Casserly, R. T. Jr. Houston, TX; Rice Univ. (1975). 98p. University Microfilms Order No. 75-22,002.

Thesis (Ph. D.).

At 0722 UT on 25 February 1972 a Nike-Tomahawk rocket payload was launched over a structured auroral arc which had a visual intensity of greater than or equal to 40 kR. An array of charged particle detectors measured the auroral electrons and protons in the energy range 0.5-20 keV while a cesium vapor magnetometer made vector magnetic field measurements along the rocket's trajectory. Perturbations in the magnetic field profile are inferred to be the result of a system of two electrojets and a pair of oppositely directed Birkeland currents. Movement and structure in the Birkeland current sheets is shown to be due to the presence of fold motion along the visual auroral band. These results are compared to the observations of the other onboard detectors and discussed in the light of related current auroral research. (Diss. Abstr. Int., B)

8246 SECULAR CYCLE OF RADIOCARBON CONTENT VARIATIONS IN THE EARTH'S ATMOSPHERE. Kocharov, G. E.; Dergache, V. A.; Sanadze, A. A. pp 163-170 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The radiocarbon content in the single tree-rings for the period 1707-1860 is investigated. The results received are compared with the variations of the solar activity. The anticorrelation between the secular variations of the solar activity and radiocarbon content variations is established. The period of ^{14}C variations is equal ~60 years. The amplitude of variations ~1%, and the shift in phase between extremal values of Wolf's number and radiocarbon content in the Earth's atmosphere ~10 years. (auth)

8247 RADIOACTIVE CARBON IN THE EARTH'S ATMOSPHERE. Dergachev, V. A.; Kocharov, G. E.; Metskhvarishvili, R. Ya.; Sanadze, A. A. pp 177-210 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The measurements of radiocarbon content in the single tree-rings for the period 1955-1972 by means of proportional and scintillational counters are carried out. Radiocarbon content in various parts of the carbon-exchange reservoir is considered too. The attention is drawn to the necessity of investigations on artificial ^{14}C mixing in oceans as the decrease of ^{14}C takes place in the zone. (auth)

8248 MINOR ION COMPONENTS IN THE DISTURBED IONOSPHERE IN THE ALTITUDE RANGE OF 100 TO 200 km. Dyadichev, V. N.; Kozlov, S. I. Cosmic Res. (USSR) (Engl. Transl.); 13: No. 2, 213-218(1975).

Translated from Kosm. Issled.; 13: No. 2, 242-248(1975).

The behavior of the minor ion components N^+, $O^+(^2D)$, $O^+(^2P)$, and O_2^+ ($^4\pi$) at altitudes of 100-200 km and their effect on the electron kinetics in the ionosphere disturbed by a pulsed source of ionization are studied. (auth)

8249 SEASONAL AND SOLAR CYCLE VARIATION OF E-REGION NITRIC OXIDE. Golshan, N.; Sechrist, C. F. Jr. (Univ. of Illinois, Urbana). Radio Sci.; 10: 305-315(Mar 1975).

From conference on recent advances in the physics and chemistry of the E-region; Boulder, CO, USA (13 Aug 1974).

Measured electron density and NO(+) to O2(+) concentration ratio data are used to deduce the seasonal and solar activity variation of E-region nitric oxide concentration. The results imply a strong dependence of NO concentration on soft X-rays leading to the possibility that dissociation of N2 by energetic photoelectrons is a major source of N(2D). Seasonal variations of the thermosphere apparently cause enhanced NO concentration in summer in agreement with the summer enhancement of experimental NO(+) to O2(+) concentration ratio. (auth)

8250 NONLINEAR SATURATION AND ANGULAR ROTATION OF INSTABILITIES IN THE E LAYER. Weinstock, J.; Rognlien, T. D. (NOAA Aeronomy Lab., Boulder, CO). Radio Sci.; 10: 231-237(Mar 1975).

From international conference on recent advances in the physics and chemistry of the E Region; Boulder, CO (13 Aug 1974).

Two plasma instabilities have been identified as causing small-scale irregularities in the equatorial E layer. These instabilities are referred to as the two-stream and gradient drift instabilities. Here a unified calculation is made of the saturated density amplitudes of these instabilities. The present nonlinear saturation mechanism is referred to as perturbed orbits or diffusing orbits. The density fluctuations required for this saturation are roughly 10 percent for the gradient drift instability and 1 percent for the two-stream instability. This agrees with rocket measurements over India. In addition, a calculation is made of the frequency shift of two-stream waves. This shift is a nonlinear effect due to the slowing down of electrons by the unstable waves, and could be viewed as an enhanced friction. It is shown that this frequency shift will cause the angular spectrum of the two-stream waves to be rotated upwards or downwards, depending on the direction of the electrojet. Such rotations have been observed by radar. (auth)

8251 PROCEEDINGS OF INTERNATIONAL CONFERENCE ON RECENT ADVANCES IN THE PHYSICS AND CHEMISTRY OF THE E REGION, BOULDER, COLORADO, AUG 13--15, 1974. Matsushita, S.; Smith, L. G. (National Center for Atmospheric Research, Boulder, CO). Radio Sci.; 10: 1-192(Mar 1975).

Papers are presented dealing with theoretical and experimental studies of the structure and dynamics of the E region, with investigations into instabilities and irregularities, ionization sources, neutral and ion chemistry, atmospheric dynamics, and electric fields and currents. Some of the topics covered include nonlinear saturation and angular rotation of instabilities in the E layer;

theoretical properties of two-dimensional electrojet turbulence; sources, intensity, and spatial distribution of ionizing nightglow; radar evidence for Fe(+) in a sporadic-E layer; tidal effects in the E region from incoherent scatter radar observations; and numerical modeling of a metallic ion sporadic-E layer. (IAA)

8252 REPORT ON THE BROOKHAVEN SOLAR NEUTRINO EXPERIMENT. Davis, R. Jr.; Evans, J. C. Jr. (Brookhaven National Lab., Upton, NY). pp 91-110 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The Brookhaven Solar Neutrino experiment has been in operation since 1968. In this report the results of 10 experiments are given that extend over the period June 1971 to January 25, 1974. From these results it was concluded that the solar neutrino capture rate in ^{37}Cl is less than 1 SNU (SNU identical with 10^{-36} captures sec^{-1} atom $^{37}Cl^{-1}$). This result can be compared to the rate of 5.6 SNU predicted by standard solar model calculations. One experimental run for the period July 7 to November 5, 1972 gave an apparent rate of 6.2 +- 2.1 SNU and is higher than any other single experiment. A search was made for a possible neutrino pulse associated with the January 4, 1974 antineutrino pulse observed by the Pennsylvania-Texas water Cherenkov detectors. Neutrinos were not observed and a limit was set to the ratio of anti nu/nu greater than or equal to 4 if the January 4th event was produced by antineutrinos. A discussion is given of various tests performed to measure the recovery of ^{37}Ar in the detector system. New experiments to test further the argon recovery, and to measure the neutrino capture cross-section in ^{37}Cl are briefly described. (auth)

8253 FEASIBILITY STUDIES ON A RADIOCHEMICAL LITHIUM SOLAR NEUTRINO EXPERIMENT. Rowley, J. K. (Brookhaven National Lab., Upton, NY). pp 111-124 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974).

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

The feasibility of performing a radiochemical lithium solar neutrino experiment is presently under study at Brookhaven National Laboratory. The progress of these studies is reported here. Good progress has been made on the separation of the product, ^{7}Be, from the target, a 12 M LiCl solution in water. Experimental studies of several suitable efficient methods for achieving this separation are discussed. Possible methods for counting ^{7}Be are listed and the results of some preliminary investigations of some of these methods are reported. Moderate success in Geiger counting ^{7}Be in the gas phase has been achieved. Background processes which can also produce ^{7}Be are also listed and the estimated backgrounds due to these processes are reported. (auth)

Magnetospheric Phenomena

Refer also to abstract 8105.

8254 (N-75-12873) FEATURES OF POLAR CUSP ELECTRON PRECIPITATION ASSOCIATED WITH A LARGE MAGNETIC STORM. Berko, F. W. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center). Nov 1974. 25p. (NASA-TM-X-70792; X-626-74-326). NTIS $3.25.

Measurements of precipitating electrons made by the OGO-4 satellite reveal several interesting phenomena in the polar cusp. Extremely high fluxes of 0.7 keV electrons were observed in the polar cusp ninety minutes following the sudden commencement of a very large magnetic storm. Structured, fairly high fluxes of 7.3 keV electrons were also observed in the cusp region, accompanied by very strong search coil magnetometer fluctuations, indicative of strong field-aligned currents. The observations confirm previously reported latitudinal shifts in the location of the polar cusp in response to southward interplanetary magnetic fields. (auth)

8255 APPROXIMATIONS FOR THE STUDY OF DRIFT BOUNDARIES IN THE MAGNETOSPHERE. Kivelson, M. G. (Univ. of California, Los Angeles); Southwood, D. J. J. Geophys. Res.; 80: No. 25, 3528-3534(1 Sep 1975).

An approximate relation between energy and equatorial radial distance for a particle of pitch angle alpha/sub eq/ moving adiabatically in a dipole magnetic field is used to describe the Alfven layer for particles of arbitrary pitch angle. The convection electric field is assumed to be uniform in the equatorial plane of the magnetosphere, and magnetic field lines are taken to be equipotentials in the region traversed by the magnetospheric particles being studied. Approximate solutions in the high- and low-energy limits are given in a form directly applicable to the interpretation of measurements at fixed particle energy and pitch angle. These results are particularly useful for electrons, since the approximations provide lower bounds to the exact solutions. The results are used to interpret recent Explorer 45 electron measurements of Williams et al. (auth)

8256 BRIEF STUDY OF THE INTERACTION MECHANISM OF MAGNETIZED SOLAR WIND STREAMS WITH THE GEOMAGNETIC FIELD: VELA 3, EXPLORERS 33 AND 35, AND MARINER 5. Jones, D. E.; Melville, J. G.; Cosman, M. A. (Brigham Young Univ., Provo, UT). pp 165-168 of Proceedings of Utah Academy of Sciences, Arts, and Letters, Vol. 51, Provo, UT; Utah Academy of Sciences, Arts, and Letters (1974).

8257 MOTION AND MAGNETIC FIELD STRUCTURE OF THE EARTH'S MAGNETIC TAIL NEAR 30 R/sub E/. Bowling, S. B. Houston, TX; Rice Univ. (1975). 118p. University Microfilms Order No. 75-21,996.

Thesis (Ph. D.).

The analysis of data taken by the NASA-GSFC magnetometer experiment on the Explorer 34 spacecraft has shown that the diurnal wobble of the geomagnetic dipole axis measurably influences the position of the magnetotail near 30 R/sub E/ (earth radii). Viewed in the solar-ecliptic coordinate system, the dipole wobble resolves into components of motion perpendicular and parallel to the earth-sun line. The perpendicular component exerts a torque on the magnetotail and causes the neutral sheet (the midplane of the magnetotail) to pivot about an axis approximately parallel to the solar-wind flow direction. The parallel component encourages the neutral sheet to move above and below the solar-magnetospheric equatorial plane with an amplitude of 1 R/sub E/, as if the neutral sheet were hinged at a geocentric distance of 5.25 R/sub E/. The motion of the neutral sheet is also characterized by a random flapping in the solar-ecliptic Z-direction at a velocity of 100 km/sec and an amplitude of +- 2 R/sub E/. Results suggest the existence of a layer of nearly uniform cross-tail electric current that is about 2.3 R/sub E/ thick and envelops the neutral sheet. The magnetic field, whose average geometry resembles a flattened and extended dipole, gradually reverses direction within this current layer. The field is perpendicular to the neutral sheet where it has a value of 2 gamma (1 gamma equals 10^{-5} Gauss). The analysis does not suggest a strong dependence of the magnetic-field configuration on the geomagnetic index Kp, although the field may intermittently disrupt into localized and short-lived magnetic loops during periods of enhanced geomagnetic activity. (Diss. Abstr. Int., B)

8258 RADIATION BELT AND CONVECTION IN THE ARTIFICIAL MAGNETOSPHERE. Podgornyi, I. M.; Dubinin, E. M.; Potanin, Yu. N. pp 221-222 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (n Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851-.

It has been shown that interaction of plasma flow, its parameters corresponding to the principle of limited simulation, with a magnetic dipole results in the formation of magnetosphere with a radiation belt. The radiation belt filling occurs on the nightside. To verify the assumption that the filling mechanism is associated with convection of closed field lines towards the tail measurements of electric field have been carried out. The electric field distribution measured is consistent with the assumed convection model. (auth)

8259 ANALYSIS OF THE RESIDUAL GEOMAGNETIC FIELD ACCORDING TO THE COSMOS-49 MODEL. Adam, N. V.; Ben'kova, N. P.; Cherevko, T. N. Cosmic Res. (USSR) (Engl. Transl.); 13: No. 2, 208-212(1975).

Translated from Kosm. Issled.; 13: No. 2, 236-241(1975).

The possibility of improving modular models through an increase in the spherical harmonic series is investigated on the basis of an analysis of the distribution of the residual field represented in the form of a map of ΔT, which is the difference between measurements on the satellite Cosmos-49 and calculated values obtained for the Cosmos-49 model. (auth)

8260 MODEL OF THE MAGNETOSPHERIC FIELD UNDER WEAKLY PERTURBED CONDITIONS. Tsyganenko, N. A. Cosmic Res. (USSR) (Engl. Transl.); 13: No. 2, 189-195(1975).

Translated from Kosm. Issled.; 13: No. 2, 215-221(1975).

A numerical model is worked out for the magnetosphere, which provides a description of the geomagnetic field out to distances

~50 R_E. The model incorporates the following field sources: a geomagnetic dipole, the current layer of the tail, which has a finite thickness, the ring current and system of currents on the magnetopause. The latter is found from the condition for a zero resultant field outside the magnetosphere. The parameters of the field sources, as well as the shape of the magnetosphere, are stipulated in accordance with experimental data. The results of calculations of the configuration of the lines of force and the deviation of the resultant geomagnetic field for a dipole field are in good agreement with the measurements. (auth)

8261 TERRESTRIAL MAGNETOSPHERE AND COMPARISON WITH JUPITER'S. Michel, F. C. (Rice Univ., Houston, TX). pp 460-471 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

A review of the characteristics of Jupiter's magnetosphere, with comparisons to the earth's is given. Radio observations of Jupiter indicate that energetic electrons are trapped in its magnetic field. The interaction of the trapped radiation with the satellite Io and the centrifugal instability of Jupiter's magnetosphere are discussed. Jupiter's outer magnetosphere is constantly accreting plasma at an uncertain rate. Various mechanisms for supplying ions to the outer magnetosphere are discussed, including: gravitational and centrifugal forces acting on corotating particles; field-line diffusion; photoelectron injection; excitation by Io or other satellites; and viscous interaction with the solar wind. The over-all morphology of the Jovian magnetosphere is sketched. The magnetosphere seems to be highly distorted by centrifugal forces and is easily compressed or deflected by the solar wind. (IAA)

8262 VARIATION OF THE RATIO OF SPECIFIC HEATS ACROSS A DETACHED BOW SHOCK. Chao, J. K.; Wiskerchen, M. J. (Univ. of Arizona, Tucson). pp 455-459 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Equations are derived which allow the ratio of specific heats behind the earth's bow shock to be evaluated if several pre-shock parameters (the specific-heat ratio, the Alfvenic Mach number, the sonic Mach number, and the angle between the shock normal at the stagnation point and the magnetic field) and the density jump across the shock are known. Numerical examples show that the dependence of the post-shock ratio on the pre-shock ratio is weak. (IAA)

8263 STRUCTURE OF THE TERRESTRIAL BOW SHOCK. Greenstadt, E. W. (TRW Systems Group, Redondo Beach, CA). pp 441-454 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From 3rd conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Preliminary results of a bow shock study which isolates various parameters are reported. The main findings are successful isolation of shock structures by parameter set, and correlated diagnostic behavior. Conventional shock structural nomenclature is first modified to suit the results of spacecraft observations and to provide the terminology needed in the remainder of the paper. Several examples of shock morphology for a wide range of plasma states are then displayed, as seen with various diagnostics. The bow shock is described as a system in the solar wind. Advantages of the bow shock as an object of shock investigation are pointed out, and a few aims of future study are outlined. (IAA)

PHYSICS (ATOMIC AND MOLECULAR)

8264 (CONF-7306123-(Absts.)) TWENTY-EIGHTH SYMPOSIUM ON MOLECULAR STRUCTURE AND SPECTROSCOPY, COLUMBUS, OHIO, JUNE 11–15, 1973. Abstracts. (Ohio State Univ., Columbus (USA)). 1973. 231p. Ohio State Univ., Columbus.

Abstracts of 326 papers given at the symposium are presented along with a list of conference participants and the symposium program. (GHT)

8265 SURFACE AND VACUUM PHYSICS INDEX. Volume 9, No. 11, 1974. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). vp.

Beams and Their Reactions

Refer also to abstract 8580.

8266 (DESY-L-Ueb-205) NUMERICAL INVESTIGATION OF THE SCATTERING OF ELECTROMAGNETIC WAVES ON THE LONGITUDINAL INHOMOGENEOUS CIRCULAR CHARGED PARTICLE BEAM IN A CIRCULAR HOLLOW WAVEGUIDE. Shvachka, A. B.; Urazakov, E. I. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). 1975. (JINR–P-9-8478). 10p. (In German). INIS.

3 figs.; 1 tabs.; 11 refs. Translated from Russian.

The problem of electromagnetic wave scattering on the bunch charged inhomogeneously in the direction of the z-axis is stated and solved in analogy to the problem of wave scattering on the bunch charged homogeneously in the direction of the z-axis. The only difference found is that for the inhomogeneous bunch the coefficients of the amplitude equation system contain additional terms of the sum which are not found for the homogeneous bunch. (GE)

8267 (JINR-P13-9146) CRYOGENIC SOURCE OF POLARIZED ATOMS OF HYDROGEN AND DEUTERIUM. Belushkina, A. A.; Vadeev, V. P.; Valevich, A. I.; Gai, G. I.; Donets, E. D.; Ershov, V. P.; Kotova, L. S.; Plis, Yu. A.; Pilipenko, Yu. K.; Smelyanskii, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1975. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.50.

An apparatus producing electron spin polarized atomic beams of deuterium and hydrogen is described. A cryopumping system, a superconducting sextupole magnet and liquid nitrogen cooled dissociator with a r.f. discharge are used. A possibility of developing of cryogenic polarized source is shown. Some advantages of such sources are discussed. (auth)

8268 DEPTH DISTRIBUTION OF SILVER IONS IMPLANTED IN Si AND SiO_2. Barcz, A. (Inst. of Nuclear Research, Warsaw); Turos, A.; Wielunski, L.; Rosinski, W.; Wojtowicz-Natanson, B. Radiat. Eff.; 25: No. 2, 91-96(1975).

In-depth profiles of 20 to 140 keV ^{107}Ag ions implanted in Si and SiO_2 were measured by elastic backscattering of 1 MeV α-particles. The results were compared with the theory of Brice. For silicon the experimental values of projected ranges and range stragglings are in good agreement with the predictions of the theory. For SiO_2 the experimental values are systematically greater than the theoretical by a factor of about 1.4. For the conversion from the energy to the depth scale a method was proposed in which a knowledge of the stopping power of α-particles is not needed. The influence of the scattering geometry on the depth resolution has also been discussed. (auth)

8269 BLOCKING EFFECTS IN MEDIUM-ENERGY ION SCATTERING BY CRYSTALS. Mashkova, E. S.; Molchanov, V. A. (Moscow State Univ.). Radiat. Eff.; 25: No. 1, 33-39 (1975).

Argon ion scattering by the (110) face of a copper crystal is experimentally investigated. The obtained data are discussed in terms of simplest model of blocking effect. (auth)

8270 APPLICATION OF HIGH RESOLUTION RUTHERFORD BACKSCATTERING TO THE MEASUREMENT OF ION RANGES IN Si AND Al. Williams, J. S.; Grant, W. A. (Univ. of Salford, Eng.). Radiat. Eff.; 25: No. 1, 55-56(1975).

The application of Rutherford backscattering for the measurement of heavy-ion ranges in light substrates. Increased depth resolution has been obtained by employing a glancing incidence scattering geometry making it possible to investigate not only the most probable ranges of low energy (< 100 keV) ions but also the ion distributions within the target. The technique is illustrated by data for the ranges of various ions in Al and Si. (auth)

8271 MOLECULAR BEAMS AND LOW DENSITY GASDYNAMICS. Wegener, P. P. (ed.). Gasdynamics, Vol. 4. New York; Marcel Dekker, Inc. (1974). 432p. $34.50.

Attention is given to the currently available information on the principles and methods of producing molecular beams by the use of nozzle sources, questions related to the formation of cluster beams in nozzle flow, and the design and the operation of low-density hypersonic wind tunnels. Diagnostic techniques in high temperature gasdynamics are also considered. (IAA)

For abstracts of individual sections see: 8272 and 8273.

8272 MOLECULAR BEAMS FROM NOZZLE SOURCES. Anderson, J. B. (Yale Univ., New Haven). pp 1-91 of Molecular Beams and Low Density Gasdynamics. Wegener, P. P. (ed.) New York; Marcel Dekker, Inc. (1974).

A historical summary is presented concerning the developments related to molecular beams obtained by nozzle beam techniques, taking into account Fleming's observations, Dunoyer's sodium beam, Stern's molecular beam program, Johnson's jet source, the Kantrowitz-Grey design, and the gasdynamics of free jets. General principles of operation are discussed along with the continuum free jet, questions of transition flow in free jets, internal relaxation processes in free jets, and free jets of gas mixtures. Other topics discussed include the interaction of jets with background gases, aspects of skimmer interference, and the free jet as a beam source. (IAA)

8273 CLUSTER BEAMS FROM NOZZLE SOURCES. Hagena, O. F. (Gesellschaft fuer Kernforschung mbH, Karlsruhe, Ger.). pp 93-161 of Molecular Beams and Low Density Gasdynamics. Wegener, P. P. (ed.) New York; Marcel Dekker, Inc. (1974).

The term cluster is used to indicate that the beam particles are assemblies of clustered atoms held together by van der Waals forces. A cluster beam system is considered along with questions concerning the condensation and cluster formation in nozzle flows, the performance of cluster beam sources, and aspects of cluster size measuement. Experiments with cluster beams are discussed, taking into account applications of cluster beams in plasma physics, the reflection of cluster beams from solid surfaces, and cluster gas scattering experiments. (IAA)

8274 SURFACE AND VACUUM PHYSICS INDEX. Volume 10, No. 7, 1975. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). vp.

Atomic and Molecular Properties

Refer also to abstracts 7959, 8172, 8457, and 8592.

8275 (AED-CONF-75-043-035) TRANSITION PROBABILITIES IN HELIUM SPECTRA. Einfeld, D. 1975. 6p. (In German). INIS.

From spring meeting of the Fachausschuesse Kurzzeitphysik and Plasma- und Gasentladungsphysik of the DPG; Duesseldorf, F. R. Germany (4 May 1975).

7 figs.

The transition probabilities of the He I line 471.3 nm was determined to be $(8.7 \pm 0.7) \times 10^6 s^{-1}$ relative to the theoretically secure He I line 501.4 nm. This value lies between the experimental and theoretical literature values. By measuring the emission coefficients and the series limit 2^3P of the corresponding Gaunt factor and assuming the continuous transition of the spectral emission coefficients at the series limit, the $A_{(nm)}$ values of the n^3D-2^3P transitions for $8 < n < 21$ were determined. (GE)

8276 WIDE ENERGY RANGE APPROXIMATION FORMULA FOR HYDROGEN GAUNT FACTOR. Sapar, A.; Kuusik, I. Publ. Tartu. Astrofiz. Observ.; 42: 272-280(1974).

A relatively simple and quite exact formula is presented for determination of the Gaunt factors for a hydrogen atom, more exactly, for hydrogenic atoms if E is treated in the units of the ionization energy of corresponding ions. (4 figs.) (GHT)

8277 INVESTIGATION OF THE HYPERFINE STRUCTURE IN THE TECHNETIUM 1-SPECTRUM AND DETERMINATION OF THE NUCLEAR QUADRUPOLE MOMENT OF ^{99}Tc. Wendlandt, D. Hanover; Technische Univ. (1974). 71p. (In German). INIS.

Thesis.

The ground state splitting and the hfs splitting of odd configurations in the technetium spectrum were measured. The results were compared with calculations using the Hartree-Fock method. Also determined was the nuclear quadrupole moment of Tc-99. (GE)

8278 CALCULATION OF BOUND STATES OF H- AND He WITH TEST FUNCTIONS OF THE K-HARMONIC METHOD. Ryabykh, Yu. I. pp 133-139 of Atomnye Protessy. Peterkop, R. K. (ed.). Riga; Izdatel'stvo Zinatne (1975). (In Russian).

Variation calculations of the bound states of H- and He were made for test functions of the K-harmonic method in an approximation of the lower members of the expansion of the wave function of the system. (tr-auth)

8279 CONTINUOUS ABSORPTION COEFFICIENT OF ATOMIC AND MOLECULAR NEGATIVE IONS. John, T. L. (University Coll. of South Wales and Monmouthshire, Cardiff, Eng.). Mon. Not. R. Astron. Soc.; 172: No. 2, 305-311(Aug 1975).

The continuous absorption coefficient of the free-free transitions of 17 atomic and molecular negative ions are reported for the temperature and wavelength ranges $100 \leq T(K) \leq 15000$, $0.5 \leq \lambda(\mu) \leq 10$. An analytical expression is given for some molecular negative ions of astrophysical interest. (auth)

8280 DIELECTRIC SATELLITE SPECTRA FOR HIGHLY-CHARGED HELIUM-LIKE IONS. II. Improved Calculations. Bhalla, C. P. (Kansas State Univ., Manhattan); Gabriel, A. H.; Presnyakov, L. P. Mon. Mot. R. Astron. Soc.; 172: No. 2, 359-375(Aug 1975).

Earlier calculations on the intensities of dielectric satellite spectra for helium-like ion resonance lines have now been revised. The revision is based upon new and improved calculations for the rates of autoionization of the levels responsible, and of their production rate by direct inner-shell excitation. The new theory makes some significant alterations in the interpretation of the intensities of observed lines from solar and laboratory plasmas, in particular in relation to the extent to which the ionization departs from the steady-state distribution. Recent improved observations of solar active regions and flares and high temperature laboratory plasmas are compared with the calculated spectra. (auth)

8281 TWO-PHOTON DECAY OF METASTABLE ATOMIC HYDROGEN. O'Connell, D.; Kollath, K. J.; Duncan, A. J.; Kleinpoppen, H. (Univ. of Stirling, Eng.). J. Phys., B (London); 8: No. 11, L214-L218(1 Aug 1975).

The two-photon decay of metastable atomic hydrogen has been observed for the first time. A series of tests which confirm the observation are described, including preliminary measurements of the angular distribution and spectral distribution for the two-photon decay. (auth)

8282 EJECTED ELECTRON SPECTROSCOPY OF AUTOIONIZING STATES EXCITED BY LOW ENERGY ELECTRON IMPACT. Hicks, P. J.; Comer, J. (Univ. of Manchester, Eng.). J. Phys., B (London); 8: No. 11, 1866-1879(1 Aug 1975).

The autoionizing states of helium that exist beneath the n = 2 threshold of He^+ have been extensively investigated using a low energy (10 to 200 eV) electron impact spectrometer. The instrument was built for studying the electron ejection spectra of autoionizing states and features a high intensity (~1 μA) incident beam and a high resolution (~40 meV) electron energy analyser. The energies of a number of autoionizing states of helium have been measured, and the values are compared with previous results of theory and experiment. In a few cases the resolution of the instrument has allowed the estimation of the widths of the very short-lived states. An outstanding feature of the spectra obtained at energies just above the thresholds for excitation of the autoionizing states is the phenomenon of displaced thresholds. Here it is found that a "post-collision interaction" effect leads to the displacement of ejected electron peaks to higher energies. (auth)

8283 INTERELECTRONIC DISTRIBUTION IN THE LOWEST $^{1,3}\pi_u$ STATES OF H_2. Colbourn, E. A. (Oxford Univ.). J. Phys., B (London); 8: No. 11, 1926-1933(1 Aug 1975).

The interelectronic distribution function $f(r_{12})$ is studied as a function of x_{12}, of y_{12}, and of z_{12} for the lowest $^{1,3}\pi_u$ states of H_2 using simple uncorrelated wavefunctions. The coordinates are defined so that the z_{12} axis is parallel to the internuclear axis, and so that the π-electron density reaches its maximum in the x_{12} direction. It is found that the distribution functions and their differences in the x_{12} direction are substantially greater than those in the y_{12} or z_{12} directions. The triplet electrons are more likely to be found at intermediate x_{12} values, while the singlet electrons have a greater probability of being found at small or large separations. The Pauli principle is thus shown to be local in effect, at least in the x_{12} direction, for the lowest $^{1,3}\pi_u$ states of H_2. This is consistent with known results for the lowest $^{1,3}P$ states of the helium atom, and accounts for the higher interelectronic repulsion in the $^3\pi_u$ state. (auth)

8284 THRESHOLD ENERGY DEPENDENCE AS A FUNCTION OF POTENTIAL STRENGTH AND THE NONEXISTENCE OF BOUND STATES. Aronson, I. (City Univ. of New York); Kleinman, C. J.; Spruch, L. Phys. Rev., A; 12: No. 2, 349-352(Aug 1975).

The difficulty in attempting to prove that a given set of particles cannot form a bound state is the absence of a margin of error; the possibility of a bound state of arbitrarily small binding energy must be ruled out. At the sacrifice of rigor, one can hope to bypass the difficulty by studying the ground-state energy E(lambda) associated with H(lambda) identical with H/sub true/ + lambda/sub nu/, where H/sub true/ is the true Hamiltonian, nu is an artificial attractive potential, and lambda greater than 0, E(lambda) can be estimated via a Rayleigh-Ritz calculation. If H/sub true/ falls just short of being able to support a bound state, H(lambda) for lambda "not too small" will support a bound state of some significant binding. A margin of error is thereby created; the inability to find a bound state for lambda "not too small" suggests not only that H(lambda) can support at best a weakly bound state but that H/sub true/ cannot support a bound state at all. To give the argument real substance, one studies E(lambda) in the neighborhood of lambda equals $lambda_0$, the (unknown) smallest value for lambda for which H (lambda) can support a bound state. A comparison of E(lambda) determined numerically with the form of E(lambda) obtained with the use of a crude bound-state wave function in the Feynman theorem gives a rough self-consistency check. One thereby obtains a believable lower bound on the energy of a possible bound state of H/sub true/ or a believable argument that no such bound state exists. The method is applied to the triplet state of H^-. (auth)

8285 COMMENT ON STRUCTURE NEAR THE CUTOFF OF THE CONTINUOUS X-RAY SPECTRUM OF LANTHANUM. Lee, C. M.; Pratt, R. H. (Univ. of Pittsburgh). Phys. Rev., A; 12: No. 2, 707-711(Aug 1975).

Recently, Liefeld, Burr, and Chamberlain observed a structure just below the cutoff frequency of the continuous x-ray spectrum of lanthanum. To understand the origin of this feature, the tip-region electron-lanthanum atomic bremsstrahlung spectrum, obtained in an independent-electron approximation with the Hartree-Slater potential, was numerically calculated for incident-electron kinetic energies from 400 to 1500 eV. The calculations do give a structure qualitatively similar to the observation. The enhancement occurs in the f-wave channel for the final scattered electron, which exhibits a resonance. Such a resonance may be expected because at this point in the periodic table the 4f subshell is about to start filling. A more quantitative description would require inclusion of many-electron and solid-state effects. (auth)

8286 RESONANCE PHENOMENA IN THE MULTIPHOTON IONIZATION OF EXCITED ATOMS. Bakos, J. (Kozponti Fizikai Kutato Intezet, Budapest). Acta Phys. Chem.; 37: No. 1-2, 115-131(1974).

The experimentally measured exponent in the power function dependence of the multiphoton ionization probability has been found to be higher than the theoretical value of the number of photons absorbed in the ionization process, contrary to the result of previous measurements. The variation of the exponent in different experimental circumstances is explained by multiphoton resonances with the atomic levels. The general dependence of the multiphoton ionization probability on the light intensity, measured over a wide range, deviates strongly from the power law dependence and can be used to determine the Stark shift of the atomic states involved. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

8287 POSITRON ANNIHILATION IN LOW-TEMPERATURE RARE GASES. I. Helium. Canter, K. F.; McNutt, J. D.; Roellig, L. O. (Wayne State Univ., Detroit). Phys. Rev., A; 12: No. 2, 375-385(Aug 1975).

The lifetime spectra of positrons annihilating in helium gas were obtained over the temperature range 4.6 to 300°K and the density range 0.016 to 0.030 g/cm^3. The spectra are decomposed into slow-positron and ortho-positronium annihilation components which are presented and discussed separately. At low temperatures, the density and temperature dependences of the data are found to depart markedly from the usual behavior observed at room temperature. Simple quantitative treatments are given of the cluster

model for the slow-positron data and of the cavity model for the ortho-positronium results. (auth)

8288 POSITRON ANNIHILATION IN LOW-TEMPERATURE RARE GASES. II. Argon and Neon. Canter, K. F.; Roellig, L. O. (Wayne State Univ., Detroit). Phys. Rev., A; 12: No. 2, 386-395 (Aug 1975).

Lifetime measurements of slow-positron and ortho-positronium (o-Ps) annihilation were made in argon and neon gases at room temperature and below. The argon experiments cover the temperature range 115 to 300°K and the density range 0.0356 to 0.0726 g/cm^3 (approximately equal to 20 to 40 amagat). The slow-positron spectra in argon exhibit a departure from free-positron annihilation below 200°K. The departure becomes more marked as the temperature is lowered. No deviation from free o-Ps pickoff annihilation is observed in argon at low temperatures. The neon measurements cover the temperature range 30 to 300°K and the density range 0.032 to 0.89 g/cm^3 (approximately equal to 35 to 980 amagat). No effect of temperature on the slow-positron spectra throughout the temperature and density ranges investigated in neon is observed. The spectra are very exponential with a corresponding decay rate which is temperature as well as time independent and is directly proportional to density over the ranges investigated. The o-Ps data are more eventful in that the o-Ps lifetime at near-liquid densities is approximately 20 nsec, a factor of nearly 4 greater than the value obtained using the pickoff-annihilation coefficient obtained at lower densities. This is evidence for positronium-induced cavities in low-temperature neon. A brief discussion of the argon and neon results is given in the context of the explanations offered for the low-temperature effects observed in helium gas. (auth)

Collision Phenomena

Refer also to abstracts 7843 and 8380.

8289 (LBL-3798) VIBRATIONAL INELASTICITY IN H_2 COLLISIONS WITH He AND Li^+. Raczkowski, A. W. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1975. Contract W-7405-Eng-48. 127p. Dep. NTIS $7.00.

Thesis.

The partially averaged version of classical S-matrix theory was applied to three-dimensional collisions of H_2 with He and Li^+. For H_2-Li^+, cross-sections for the de-excitation of H_2 from (n_i,j_i) equals (1,0) to the ground vibrational manifold were computed at a total energy of 1.2 eV and compared to previously done coupled channel calculations of Schaefer and Lester. The agreement is very good. For H_2-He, the Kutzelnigg-Tsapline interaction potential was extended to small atom-diatom separations, the ab initio points were then fit to an analytic form, and cross sections for the de-excitation of H_2 from the states (n_i,j_i), n_i equals 1, j_i equals 0,2,4 to the ground vibrational manifold were computed at total energies of .9, 1.1, 1.3 and 1.5 eV. For comparison, coupled channel calculations were also performed on the system at the same energies. The agreement was poorer than in the H_2-Li^+ case, for identifiable reasons. The cross sections were used to compute rate constants and relaxation times for the H_2-He system. Comparison of these results with the results of experiment and of other calculations shows good agreement, certainly within the expected errors. (7 figs., 30 refs., 3 tables) (auth)

8290 ACTIVATION OF GROUP III ATOMS BY ELECTRON IMPACT. Ryabykh, Yu. I. pp 124-132 of Atomnye Protessy. Peterkop, R. K. (ed.). Riga; Izdatel'stvo Zinatne (1975). (In Russian)

Effective cross sections for activation of transitions of the type $ns^2np^2P_{j_2} \leftarrow ns^2n'l^2L_{j_1}$ in B, Al, Ga, and In atoms were calculated in a Born approximation and those of the type $ns^2np\ ^2P_{j_0} \rightarrow nsnp^2\ ^4P_{j_1}$ in B and Tl atoms in a Born-Ochkur approximation. (tr-auth)

8291 COLLISIONS OF SLOW ELECTRONS WITH ALKALI EARTH ATOMS. Fabrikant, I. I. pp 80-123 of Atomnye Protessy. Peterkop, R. K. (ed.). Riga; Izdatel'stvo Zinatne (1975). (In Russian)

Theoretical and experimental work on problems of collision cross sections for slow electrons with alkali earth element atoms is surveyed. The results of calculations of cross sections for elastic dispersion and activation of low levels by a strong bond method are presented. Calculations were made for three approximations, corresponding to different variants of bond selection. The results were compared with experimental data. Better agreement of the theoretical calculations with experimental data were obtained from activation cross-sections of Ca atoms. Polarization of radiation of the alkali earth atoms with zero nuclear spin and of those activated with electron impact was calculated. (tr-auth)

8292 COMMENT ON THE DISSOCIATIVE IONIZATION OF H_2. Hazi, A. U. (Univ. of California, Los Angeles). J. Phys., B (London); 8: No. 11, L262-L264(1 Aug 1975).

The available theoretical predictions for the energy of the $^1\pi_u(1\sigma_u 2\pi_g)$ autoionizing state of H_2 are compared. The present results cast serious doubt on a previous assignment of this state as the state responsible for the 4eV protons which are observed in the dissociative ionization of H_2 by electron impact. (auth)

8293 IMPORTANCE OF BEING CORRECTLY POLARIZABLE. Ho, Y. K.; Fraser, P. A. (Univ. of Western Ontario, London). J. Phys., B (London); 8: No. 11, L230-L235(1 Aug 1975).

Evidence is presented, in the context of the position-hydrogen atom zero-energy scattering problem treated with approximate (distorted) hydrogen wave functions, that it is important in a low energy scattering calculation involving an approximate target wave function that this target function should display the correct polarizability. The calculations have been carried out through "variant iv" of Peterkop and Rabik and through the "method of models" of Drachman. (auth)

8294 ELECTRON IMPACT EXCITATION OF H AND He^+. V. Differential Cross Sections for the Excitation of the n = 2 Levels of Atomic Hydrogen at Intermediate Energies. McDowell, M. R. C. (Royal Holloway Coll., Englefield Green, Eng.) Morgan, L. A.; Myerscough, V. P. J. Phys., B (London); 8: No. 11, 1838-1850(1 Aug 1975).

Differential cross sections for electron impact excitation of the 2s and 2p states of atomic hydrogen have been calculated at all angles for energies 50(50)200 eV in a distorted wave polarized orbital approximation (allowing for target distortion). The results are compared with other theoretical models, and the total n = 2 excitation differential cross sections are compared with recent absolute experimental data of Williams and Willis (J. Phys. B. Atom. Molec. Phys.; 8: 1641-69(1975)). There is complete agreement at small and moderate angles, but the method underestimates the experimental results in the backward direction. It is argued that the inclusion of final-channel distortion effects will remedy this defect. The effect of target distortion on the $1s \rightarrow 2p$ total cross section is discussed. (auth)

8295 ONE- AND TWO-ELECTRON-LOSS CROSS SECTIONS FROM FAST He^- IONS IN HYDROGEN, HELIUM, AND ARGON. Heinemeier, J.; Hvelplund, P.; Simpson, F. R. (Univ. of Aarhus, Denmark). J. Phys., B (London); 8: No. 11, 1880-1885(1 Aug 1975).

The single- and double-electron-loss cross section for He^- ions passing through H_2, He and Ar gas targets have been studied in the impact-energy range from 100 keV to 3 MeV. He^- ions were formed from He^+ by charge transfer in a gas cell and the cross sections were determined by the initial-growth method. The experimental results for single-electron loss are compared with theoretical estimates based upon the semi-emptrical classical impulse approximation of Bates and Walker. For H_2 and Ar targets, theory and experiment agree well within experimental error while the present results for He targets are 20% higher than the theoretical values. (auth)

8296 SCATTERING OF P-WAVE POSITRONS BY HELIUM. Campeanu, R. I.; Humberston, J. W. (University Coll., London). J. Phys., B (London); 8: No. 11, L244-L248(1 Aug 1975).

Kohn's variational method is used to calculate low energy positron-helium p-wave phaseshifts and p-wave contributions to the annihilation rate parameter Z_{eff} for the two helium models considered previously by Humberston. The phaseshifts for both models are less positive than the lowest set of Drachman, but the cross sections and annihilation rates obtained from the present results and Humberston's s-wave results, for the more elaborate helium function, are in good agreement with the experimental values of Canter et al, and Coleman et al. (auth)

8297 MEASUREMENT OF THE DIFFERENTIAL CROSS SECTION FOR COMPTON SCATTERING BY BOUND ELECTRONS. Spitale, G. C. Davis, CA; Univ. of California (1974). 45p. University Microfilms Order No. 75-15,460.

Thesis (Ph.D.).

Singly differential cross sections for incoherent scattering by K-shell electrons have been measured for incident photons having energies of 662 keV, 320 keV and 145 keV. The spectral distributions of scattered photons have also been examined. Target materials were iron, tin, holmium, and gold at 320 keV; tin and gold at 662 keV; and iron and tin at 145 keV. It was not, however, possible to draw specific conclusions from the 145-keV data. A typical spectrum at 320 keV consisted of a scattered peak which was much narrower than would be expected from the bound state electron motion. Rather than monotonically increasing with atomic number as expected, the peak width reached a maximum near Z equals 50 and then decreased with increasing atomic number. The peak also

reached a maximum width for a scattering angle between 45 and 60^0. The same angular behavior was observed at 662 keV and the peaks in the gold spectra were narrower than corresponding peaks in the tin spectra. The peak is superimposed on a continuum which appears to diverge at the low end of the scattered photon spectrum for the following cases: gold, holmium, and tin targets for 320-keV incident photons; and gold and possibly tin targets for 662-keV photons incident. This infrared divergence is expected on general grounds and has been predicted. The observed "infrared" continuum is very nearly isotropic. As far as is known, no other experimental work has shown these anomalous effects. (Diss. Abstr. Int., B)

8298 DIPOLE SPECTRUM OF WATER VAPOR AND ITS RELATION TO THE ENERGY LOSS OF FAST-CHARGED PARTICLES. Zeiss, G. D. (Univ. of Western Ontario, London); Meath, W. J.; MacDonald, J. C. F.; Dawson, D. J. Radiat. Res.; 63: No. 1, 64-82 (Jul 1975).

Experimental and theoretical photoabsorption and photoionization cross sections and quantum mechanical sum rules are used to construct nonrelativistic dipole oscillator strength distributions for the following "processes" involving the ground state water molecule: total absorption, total ionization, total excitation to neutral species, and partial ionization to the ions H_2O^+, OH^+, and H^+. These distributions are used to evaluate a number of dipole oscillator strength sums that are important in the radiation physics and chemistry of the water molecule and in the evaluation of the dipole properties of H_2O. Various parameters that occur in the Bethe–Born approximation for the total inelastic scattering cross sections that characterize the energy loss spectrum of fast-charged particles in water vapor are also evaluated and, where possible, compared with experimental results. The dipole oscillator strength sums are also used to evaluate the mean excitation energies for the stopping power and straggling of fast-charged particles in water vapor: I_0 equals 70.8 eV and I_1 equals 935 eV. (2 figs, 5 tables, 67 refs) (auth)

8299 SURFACE AND VACUUM PHYSICS INDEX. Volume 10, No. 3, 1975. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). vp.

8300 SURFACE AND VACUUM PHYSICS INDEX. Volume 10, No. 4, 1975. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). vp.

8301 SURFACE AND VACUUM PHYSICS INDEX. Volume 10, No. 5, 1975. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). vp.

8302 SURFACE AND VACUUM PHYSICS INDEX. Volume 10, No. 6, 1975. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). vp.

Atomic Theory

8303 (CONF-710674-(Absts.)) TWENTY-SIXTH SYMPOSIUM ON MOLECULAR STRUCTURE AND SPECTROSCOPY, COLUMBUS, OHIO, JUNE 14–18, 1971. Abstracts. (Ohio State Univ., Columbus (USA)). Jun 1971. 120p. Ohio State Univ., Columbus, Ohio.

265 abstracts are presented of papers on molecular structure and spectroscopy. Included in the proceedings are a key to the abstracts, author list, and conference program. (GHT)

8304 MULTIPHOTON IONIZATION OF HYDROGEN ATOMS FROM THE GROUND STATE. Karule, E. M. pp 5-24 of Atomnye Protessy. Peterkop, R. K. (ed.). Riga; Izdatel'stvo Zinatne (1975). (In Russian)

Multiphoton processes on atomic hydrogen in a nonrelativistic dipole approximation were studied. An analytical expression was obtained for the total element of the transition matrix from the ground state in the continuous spectrum, summarized along the orbital momenta of all intermediate virtual states. The intensity of the transition was calculated for from 2- to 16-photon processes. (tr-auth)

8305 COMMENT ON ATOMIC INDEPENDENT-PARTICLE MODELS. Doda, D. D.; Gravey, R. H.; Green, A. E. S. (Univ. of Florida, Gainesville). Phys. Rev., A; 12: No. 2, 712-714 (Aug 1975).

The Hartree-Fock-Slater (HFS) independent-particle model in the form developed by Hermann and Skillman (HS) and the Green, Sellin, and Zachor (GSZ) analytic independent-particle model are being used for many types of applications of atomic theory to avoid cumbersome, albeit more rigorous, many-body calculations. The single-electron eigenvalues obtained with these models are examined and it is found that the GSZ model is capable of yielding energy eigenvalues for valence electrons which are substantially closer to experimental values than are the results of HS-HFS calculations. With the aid of an analytic representation of the equivalent HS-HFS screening function, the difficulty with this model is identified as a weakness of the potential in the neighborhood of the valence shell. Accurate representations of valence states are important in most atomic applications of the independent-particle model. (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

Refer also to abstract 8431.

8306 PHOTOGRAPHS OF QUANTIZED VORTEX LINES IN ROTATING SUPERFLUID HELIUM. Williams, G. A. Berkeley, CA; Univ. of California (1974). 102p. University Microfilms Order No. 75-16,826.

Thesis (Ph. D.).

The spatial positions of quantized vortex lines in rotating He II have been determined using a photographic technique. Electrons are trapped on the vortices and then extracted through the liquid surface and accelerated into a phosphor screen. The light from the phosphor is transmitted to room temperature with coherent fiber optics and photographed with an image intensifier camera. Photographs taken with pure ^{4}He at T equals 0.3 K were complete blurs. These blurs are attributed to nonequilibrium motion of the vortices, arising from the lack of normal fluid damping at this temperature. To resolve the individual vortex lines it was found necessary to add ^{3}He to the ^{4}He sample to damp the vortex motion. Photographs are presented for ^{3}He concentrations up to 1.6 percent. The number of vortices visible varies linearly with rotation speed, but is only about one-half the number expected from theory. The vortex lines in the apparatus were not observed to form a stable array. (auth)

8307 MELTING PROPERTIES OF ^{3}He: SPECIFIC HEAT, ENTROPY, LATENT HEAT, AND TEMPERATURE. Halperin, W. P. Ithaca, NY; Cornell Univ. (1975). 159p. University Microfilms Order No. 75-17,994.

Thesis (Ph. D.).

A sequence of experiments have been performed that were designed to measure thermal properties of liquid and solid ^{3}He between the temperatures 1 and 25 mK, at melting curve densities. A two-phase mixture of ^{3}He sample was self-cooled by the Pomeranchuk method. A heat pulse technique was used, combined with measurements of pressure and volume, to yield separate determinations of liquid and solid properties: the specific heat of liquid ^{3}He in the normal Fermi liquid and superfluid phases; the entropy of solid ^{3}He above and through a nuclear magnetic transition at 1.10 mK; and an absolute thermodynamic temperature scale based on measurement of latent heat of conversion of liquid to solid. (auth)

8308 FOURTH SOUND IN LIQUID HELIUM THREE. Yanof, A. W. Ithaca, NY; Cornell Univ. (1975). 169p. University Microfilms Order No. 75-18,008.

Thesis (Ph. D.).

Experimental proof of superfluidity in the recently discovered millikelvin phases of liquid ^{3}He is described. Using fourth sound, the superfluid density has been measured. The experimental cell was pre-cooled to 15 millikelvin by a dilution refrigerator and cooled about .2 millikelvin below the second order phase transition temperature by demagnetizing finely powdered cerium magnesium nitrate. Fourth sound was generated in the liquid by applying an oscillating force to the suspended sample chamber. Resonances were detected by measuring the displacement of the cell. In our analysis, we obtain the superfluid density in two distinct ways. The superfluid fraction as a function of temperature and pressure can be deduced from the fourth sound velocity, which has been measured. An independent value for the superfluid mass can also be obtained directly from the strength of the cell response to a fourth sound resonance. Comparison of the two measurements of superfluid density allows a check of the validity of a two-fluid model of fourth sound in ^{3}He. The analysis takes careful account of the complications arising from the random, tortuous geometry in which the superfluid must flow. The quality factor of fourth sound resonances and the superfluid velocity at resonance are also extracted. The superfluid fraction of liquid ^{3}He depends approximately linearly upon reduced temperature near the second order phase transition. No discontinuity appeared in the superfluid density as the cell crossed the temperature of the first order transition from "A" phase to "B" phase. The superfluid density measured directly from cell response is within ten percent of agreement with the values deduced from fourth sound velocity. The quality factor of fourth sound resonances is a weak function of temperature, and no values of Q greater than 65 were observed. The maximum superfluid velocity reached in this experiment was about 1 mm-sec^{-1}. (auth)

8309 SUFFICIENT CONDITIONS FOR STABILITY OF COMPLETELY CONFINED FLUIDS IN PRESENCE OF MAGNETIC FIELD. Srivastava, R. K. (Defence Labs., Jodhpur, India); Srivastava, K. M. Def. Sci. J. (New Delhi); 24: 101-106(Jul 1974).

The effect of a magnetic field on an electrically conducting incompressible fluid, completely confined in a smooth container of arbitrary shape, has been studied. The temperature gradient, concentration gradients, and time-independent magnetic field are assumed to act parallel to the body force. Two Rayleigh numbers, the modified Rayleigh number MR and the critical Rayleigh number Rc, have been obtained. It is found that instability occurs if Mr is less than Rc. (auth)

8310 PHENOMENON OF THE HYDRODYNAMIC BOUNDARY LAYER IN UNSTEADY ROTATIONAL FLOW. Cantrak, S.; Askovic, R. (Univ., Belgrade). Bull. Math.; 17: No. 1, 17-27 (1973). (In French)

A successive approximation technique is applied to the solution of the MHD boundary layer equations for a body situated in an accelerated and a periodic (harmonic) rotational flow at magnetic Reynolds numbers small enough to neglect the magnetic field induced by the flow. The solutions to both problems are analyzed, showing that the usually observed steady external boundary layer flow about a body performing harmonic oscillations does not exist in the case of a hydrodynamic boundary layer. (IAA)

8311 QUANTIZATION OF THE HYDRODYNAMIC MODES IN SUPERFLUID ^{4}He WITH A FREE SURFACE. Saam, W. F. (Ohio State Univ., Columbus). Phys. Rev., B; 12: No. 1, 163-168(1 Jul 1975).

Quantization of the hydrodynamic modes in superfluid ^{4}He with a free surface is carried out. A complete and orthonormal set of eigenfunctions for both ripplons and surface-reflected phonons is constructed. Applications of the formalism to the calculation of the thermal energy density near the surface, the temperature-dependent part of the surface tension, and the rate at which power is absorbed by the surface from an incident phonon beam are given. (auth)

8312 DENSITY PROFILE OF A QUANTIZED VORTEX LINE IN SUPERFLUID ^{4}He. Harper, J. H.; Kobe, D. H. (North Texas State Univ., Denton). Phys. Rev., B; 12: No. 1, 169-179 (1 Jul 1975).

The relative-density amplitude profile of a quantized vortex line in He II is calculated from a generalized Gross-Pitaevskii (GP) equation. The ordinary GP equation is a Hartree nonlinear integrodifferential equation for the order parameter of an interacting system of bosons. The generalization is made by replacing the two-body potential in the average field by a local T matrix, which is calculated from a realistic interatomic potential for helium. In configuration space the T matrix is similar to the potential, except in the repulsive region where it is much softer. The only adjustable parameter in the generalized GP equation is the condensate fraction for which a theoretical value of 0.10 and an experimental value of 0.024 are used. In all cases the density profile is a monotonically increasing function with an effective core radius of from 3.7 to 4.7 A. (8 figures) (auth)

8313 MAGNETIZATION RINGING IN THE B PHASE OF SUPERFLUID ^{3}He. Maki, K.; Ebisawa, H. (Univ. of Southern California, Los Angeles). J. Low Temp. Phys.; 21: No. 5/6, 475-487(Dec 1975).

The ringing of magnetization in superfluid ^{3}He–B is studied theoretically for two configurations: the ringing in the Leggett configuration in the presence of a transverse field and the longitudinal ringing in the parallel plate configuration. It is shown that the time variation of the magnetization is described in terms of three distinct ringing frequencies in these general configurations. (5 figures) (auth)

8314 SUPERFLUID ^{3}He IN RESTRICTED GEOMETRIES. Barton, G.; Moore, M. A. (Univ. of Sussex, Brighton, Eng.). J. Low Temp. Phys.; 21: No. 5/6, 489-515(Dec 1975).

It is shown that finite size effects stabilize a variety of phases in superfluid ^{3}He which do not occur in the bulk liquid. These phases are formed at temperatures at which the coherence length is comparable with the smallest linear dimension of the system. Right circular cylindrical geometries are considered explicitly. (auth)

8315 GENERALIZED GINZBURG–LANDAU APPROACH TO THE SUPERFLUIDITY OF HELIUM 3. Cross, M. C. (Univ. of Cambridge, Eng.). J. Low Temp. Phys.; 21: No. 5/6, 525-534 (Dec 1975).

The coefficients in the expansion of the free energy and supercurrents in gradients of the order parameter are calculated from the microscopic Hamiltonian for all temperatures, first for a gas

model and then including Fermi liquid corrections. This provides the basis for a simple discussion of the supercurrents and collective modes. The magnitude of the intrinsic orbital angular momentum in the Anderson–Brinkman–Morel phase is calculated and found to be T/sub c//E/sub F/ smaller than previous estimates. (auth)

8316 SELF-CONSISTENT CALCULATION OF THE LONGITUDINAL NMR FOR THE BALIAN–WERTHAMER AND ANDERSON–BRINKMAN–MOREL STATES OF SUPERFLUID ^{3}He. Tewordt, L.; Fay, D.; Doerre, P.; Einzel, D. (Univ., Hamburg). J. Low Temp. Phys.; 21: No. 5/6, 645-667(Dec 1975).

The general equations of motion for the Green's functions and correlation functions and the associated conservation laws for an anisotropic superfluid are derived. This leads to a simple commutator relation for the total angular momentum of the system and the p-wave pair amplitude. The longitudinal NMR frequencies for both the Balian–Werthamer (BW) and Anderson–Brinkman–Morel (ABM) states are calculated rigorously within the self-consistent random phase approximation scheme, taking account of all the degrees of freedom of the complex fluctuations of the order parameter (18 components) and their couplings via the dipole interactions. The results for the low-frequency resonances (omega much less than DELTA) are in agreement with those of Leggett except in the vicinity of T/sub c/. In addition, in the presence of the dipole interaction, we find longitudinal resonances at omega equals (8/5)/sup 1/2/DELTA and omega equals 2/sup 1/2/DELTA for the BW and ABM states, respectively. (2 figures) (auth)

8317 THEORY OF LARGE AMPLITUDE ALFVEN WAVES. Goldstein, M. L.; Klimas, A. J.; Barish, F. D. (Goddard Space Flight Center, Greenbelt, MD). pp 385-387 of Solar Wind Three. Russell, C. T. (ed.). Los Angeles; Univ. of California (1974).

From third conference on solar wind three; Pacific Grove, CA, USA (25 Mar 1974).

Solutions of the MHD equations are derived, which describe the propagation of nonplanar large-amplitude Alfven waves in an infinite homogeneous plasma with no background flow. Some features of interplanetary Alfven waves are discussed, and a typical solution is described qualitatively. (IAA)

PHYSICS (HIGH-ENERGY)

Refer also to abstract 7914.

Particle Interactions and Properties (Experimental)

8318 (COO-3539-6) EXPERIMENTAL INVESTIGATION OF PION DECAYS AT THE CLINTON P. ANDERSON MESON PHYSICS FACILITY. Progress Report, September 1, 1974–August 31, 1975. Auerbach, L. B.; Highland, V. L.; McFarlane, W. K. (Temple Univ., Philadelphia, Pa. (USA). Dept. of Physics). 1975. Contract AT(11-1)-3539. 11p. Dep. NTIS $4.50.

The pi^0 spectrometer to be used in the pion beta-decay experiment (LAMPF experiment 32) was fully tested at LAMPF using the charge exchange reaction pi^- p yields pi^0n. Enough data is in hand to provide a satisfactory pi^0 efficiency calibration, and to guide improvements in the apparatus and computer programs. The full pion beta-decay apparatus was assembled on the P^3 beam line last summer in a period of less than two weeks, and was operated to determine sources of backgrounds and accidental rates. Several changes are underway in this apparatus, but running has been postponed until a primary beam of the order of 300 mu A is available from LAMPF. Preparations for the pi^0 yields 3 gamma experiment (LAMPF experiment 144) are now actively underway, and one expects them to be substantially complete this summer. A collaboration was begun with the University of New Mexico group (D. Wolfe et al) on problems of nucleon–nucleon scattering (i.e., on neutron-proton elastic scattering and single pion production in proton-proton scattering-LAMPF experiments 193 and 124). These proposals have now been approved and scheduled. (auth)

8319 (UCSC-34P197X4) EXPERIMENTAL RESEARCH IN HIGH ENERGY PHYSICS. Progress Report. Heusch, C. (California Univ., Santa Cruz (USA)). 1975. Contract E(04-3)-34. 8p. Dep. NTIS $4.50.

Research on experimental high energy physics is summarized. A list of publications is included. (JFP)

Electromagnetic

8320 (LBL-4289) STATUS OF SEARCHES FOR MAGNETIC MONOPOLES. Eberhardt, P. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 8 Oct 1975. Contract W-7405-Eng-48. 6p. (CONF-750858-12). Dep. NTIS $4.50.

From meeting of the ASP division of particles and fields; Seattle, Washington, USA (27 Aug 1975).

The recent experiment reporting the discovery of a monopole is compared to the negative experiments performed previously. The different determinations of the flux of monopoles are contradictory. It is likely that the event reported as a monopole may be given another interpretation. (auth)

8321 (LBL-4311) EXPERIMENTAL STATUS OF HIGH-SPIN STATES. Stephens, F. S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1975. Contract W-7405-Eng-48. 28p. (CONF-750976-1). Dep. NTIS $5.00.

From conference on highly excited states of nuclei; Juelich, F.R. Germany (22 Sep 1975).

Changes occurring in high spin nuclear states are discussed. Experimental methods for studying reduction and eventual quenching of pairing interactions, changes in nuclear shapes, and alignment of individual particle angular momenta with increasing spin are reviewed. Emphasis is placed on the study of continuum gamma rays following heavy ion reactions. (12 figures) (SDF)

8322 (RL-73-022(Rev.)) SUGGESTED EXPERIMENTAL SEARCH FOR HEAVY LONG-LIVED INTEGRALLY CHARGED PARTICLES. Smith, P. F. (Science Research Council, Chilton (UK). Rutherford Lab.). Jan 1975. 46p. Dep. NTIS (US Sales Only) $5.00.

Although extensive searches for possible fractionally charged particles have been made, there has not yet been a corresponding effort to attempt the more difficult experimental problem of integrally charged particles. The problem is assessed from two viewpoints, enrichment and detection. A number of possible detection techniques are considered. The presence of unstable but long-lived particles (lifetime > 10^6s) would be registered by means of a small detector array sensitive to high energy decay products emanating from the enriched sample; a background rate ~ 10^{-2}/day would improve on existing concentration limits by a factor 10^6. For fully stable particles, mass spectrometry of D_2 gas from the enriched D_2O samples would give an overall sensitivity corresponding to initial concentrations in H_2O down to the region 10^{-23} to 10^{-24}. An experimental program based on these techniques was initiated. As an alternative approach, the possibility of heavy particle detection by using the enriched sample as the target in a scattering experiment is considered. It is shown that this is, in principle, capable of achieving a similar overall sensitivity and would offer a possible method of confirming any positive mass spectrometry result. (auth)

8323 INCLUSIVE γ PRODUCTION IN K^+p INTERACTIONS AT 8.2 GeV/c. Krakow Bubble Chamber Group. pp 302-306 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale de Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868.

Results on the production of photons in the inclusive K^+p interactions at 8.2 GeV/c are presented. The average number of π^o per event and its dependence on the charge multiplicity were calculated. The comparison with the simple statistical isospin independence model is presented. (auth)

Weak

8324 SOME RESULTS OF HADRON PRODUCTION IN INELASTIC μp AND rho p SCATTERING EXPERIMENTS AT THE STANFORD LINEAR ACCELERATOR LABORATORY. Ballam, J. (Stanford Univ., CA). pp 244-268 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Instituto Nazionale Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868.

The main features of the reactions $\mu^- p \rightarrow \mu^-$ + hadrons and e^- + $p \rightarrow e^-$ + forward hadrons are reported. Cross section relations, averaged charged multiplicity, vector meson electroproduction in exclusive γ + p interactions, and inclusive γ + p interactions are considered. (JFP)

Strong (Baryon-induced)

Refer also to abstracts 8388 and 8452.

8325 (COO-3065-124) STUDIES OF NEUTRON DISSOCIATION AT FERMILAB ENERGIES. Ferbel, T. (Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). 21 Aug 1975. Contract E(11-1)-3065. 41p. (UR-546). Dep. NTIS $5.00.

The characteristics of diffraction dissociation of neutrons into p pi^- systems at high energies were examined. A substantial correlation is observed between the mass and the t of the produced system. The spin structure of the p pi^- amplitudes at low mass is very complex, but is described surprisingly well by the simple Deck Mechanism. Both pi-exchange and proton-exchange contributions are evident in diffractive production. The t-channel and s-channel helicity amplitudes contain comparable contributions from flip and nonflip terms and the produced states are not restricted to those expected on the basis of the Morrison rule. (auth)

8326 (UCI-34P149X4) HIGH ENERGY PHYSICS STUDIES. Progress Report, October 1, 1974–September 30, 1975. Condon, P. E.; Schultz, J. (California Univ., Irvine (USA). Dept. of Physics). 1975. Contract AT(04-3)-34. 71p. Dep. NTIS $5.50.

Progress is reported on research conducted by the High Energy Physics Group of the Irvine campus of the University of California, during the contract year beginning October 1, 1974. Work was performed on six projects: Completion of the analysis of proton-antiproton interactions between 0.1 and 1.1 GeV/c, Analysis of an exposure in the 30 inch BNL bubble chamber with deuterium fill, Running and analysis of an experiment to study K^0/sub L/p interactions in the momentum range 2 to 6 GeV/c, Preparation of an experiment to study production of massive mu pairs in K^0/sub L/-nucleon interactions, Preparation of an experiment to study direct electron production at SLAC-SPEAR, Analysis of small angle pp data from CERN-ISR. (auth)

8327 NEUPRUGIE VZAIMODEISTVIYA NUKLONOV PRI VYSOKIKH ENERGIYAKH. (Inelastic Interaction of Nucleons with High-Energy Nucleons). Takibaev, Zh. S.; Boos, E. G. Alma-Alta, USSR; Izdatel'stvo Nauka Kazakhskoi SSR (1974). 303p.

The results of many years of study of inelastic interaction and methods of treating them in tracking equipment (pulse chambers, nuclear emulsions) used for analysis of proton-nucleon interaction at energies greater than 10 GeV are presented. The course of topological sections in inelastic proton-nucleon interactions, distribution according to multiplicity and related problems of correlation among values are given. The state of secondary particles and characteristics of proton-proton and proton-neutron interactions are discussed. Kinematic characteristics of secondary particles from semi-inclusive reactions are analyzed in detail, and the most important, in our opinion, characteristics of inelastic interaction of nucleons are clarified. The contribution of isobaric states of nucleons to generation of pions is studied, and the dependence of the mechanism of two-particle reactions on different quantum numbers forming nucleon resonances is presented. Special attention is given to inclusive reactions. Together with a survey of theoretical considerations and experimental results comprising data presented at the international conference in Batavia in 1972, a new theoretical scheme describing inclusive processes based on general quantum mechanical considerations is discussed. (tr-auth)

8328 SIMILARITIES OF Δ^{++} PRODUCTION IN P–P AT 303 Gev;c AND IN (NEGATIVE MESON)-P AT 16 GeV/c. Pless, I. A. (Massachusetts Inst. of Tech., Cambridge). pp 88-90 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale de Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868.

The similarities between Δ^{++} production in proton–proton interactions at 303 GeV/c and Δ^{++} production in negative meson–proton interactions at 16 GeV/c are shown. An attempt is made to find the production mechanism at 15 GeV/c and relate that to the mechanism at 303 GeV/c. It is concluded that all the Δ^{++} particles are produced with a π^- such that they form a low $\Delta^{++}\pi^-$ mass. This low mass has characteristic diffraction features in shape and slope. It is suggested that the same diffractive mechanism is responsible for the Δ^{++} production at 303 GeV/c. (JFP)

8329 CORRELATIONS AT THE ISR. Bellettini, G. (Istituto Nazionale di Fisica Nucleare, Pisa, Italy). pp 140-153 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale de Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868.

The clustering of tracks in rapidity is discussed in a somewhat pictorial and intuitive way. Two-body correlation functions are also discussed more quantitatively. (JFP)

8330 MULTIPLICITIES AND CORRELATIONS IN PARTICLE PRODUCTION AT NAL. Lach, J. (National Accelerator Lab., Batavia, IL). pp 154-165 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale de Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868.

The review of particle correlations includes a scaling relation, antiproton interactions at 14.75 Gev/c, properties of the multiplicity distribution associated with diffractive events especially the 303-GeV/c protons in the bubble chamber for the purpose of isolating diffractive component through the use of a t cut. A comparison is made between recent results for pp and πp regarding their missing-mass-squared distributions. (JFP)

8331 NEW RESULTS FROM THE 30-GeV/c REGION. Schuebelin, P. pp 166-171 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale de Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868.

The dependence of the mean charged multiplicity $\bar{N}_{CH}$ on the transverse momentum $P_\perp$ of the forward proton in the reaction $p + p \rightarrow p + MM$ for five intervals of missing mass MM. It is found that there is a sharp increase of $\bar{N}_{CH}$ in pp collisions at 28.5 GeV/c when $P_\perp$ to the trigger proton is larger than 1 GeV/c. There is an indication from the data that one is observing mainly target fragmentation, at least for MM < 3 GeV. The observed dependence of $\bar{N}_{CH}$ with $p_\perp$ is not predicted by existing models. (JFP)

8332 pp INTERACTIONS AT 102 AND 405 GeV/c. Cohen, D. (Univ. of Rochester, NY). pp 172-190 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

The pp interactions at 192 and 405 GeV/c were studied in a bubble chamber including cross sections, charged-particle multiplicity distributions, the diffractive component, inclusive pion production, and charged-particle correlations. (JFP)

8333 CHARGE DISTRIBUTIONS AND HEMISPHERE CHARGE EXCHANGE IN INELASTIC pp AND K^-p COLLISIONS. Breitenlohner, P. pp 282-289 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

Data are presented on spectra, cross sections, and rapidity for pp and K^-p charge-exchange interactions. (JFP)

8334 ANGULAR MOMENTUM IN THE PION CLOUD. Erwin, A. pp 296-298 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

A search was made for the angular momentum in the pion cloud produced by 28.5-GeV/c pp collisions. The angular distributions are studied. (JFP)

8335 STRANGE PARTICLE PRODUCTION CROSS SECTIONS IN PROTON–PROTON COLLISIONS AT 19 GeV/c. Yamdagni, N. pp 307-310 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

Preliminary results on topological cross sections are presented for pp interactions at 19 GeV/c. Various strange particle production combinations are studied. The average charged multiplicity associated with the categories is also shown. (JFP)

8336 INVESTIGATION OF THE REACTIONS pp → pp + MESON RESONANCE AT 12 AND 24 GeV/c. Blobel, V. pp 597-601 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

The reactions pp → pp + meson resonance at 12 and 24 GeV/c were investigated. Cross sections ρ^0, ω, and f are discussed. The possible exchange α_1 and α_2 in double-Regge calculations is considered using the CLA parametrization. Also an upper limit is found for S*(1000) production. Mass, rapidity, and momentum transfer distributions are also shown. (JFP)

8337 MEASUREMENT OF POLARIZATION FOR SMALL ANGLE p–p ELASTIC SCATTERING AT 396 MeV. Aebischer, D.; Favier, B.; Greeniaus, G.; Hess, R.; Junod, A.; Lechanoine, C.; Nikles, J. C.; Rapin, D.; Werren, D. W. (Univ. of Geneva). Helv. Phys. Acta; 48: 48-50(1975).

The analyzing power $P(\theta)$ was measured for p–p elastic scattering at 396 MeV incident proton energy in the angular range $4° < \theta_{CM} < 22°$. The complete azimuthal angle distribution was observed using a system of multiwire proportional chambers placed directly in a 37% polarized beam. By changing the orientation and sign of the beam polarization, systematic errors in the system were eliminated. (auth)

8338 REACTION pp → π^+d AT 576 MeV. Aebischer, D.; Favier, B.; Greeniaus, G.; Hess, R.; Junod, A.; Lechanoine, C.; Nikles, J. C.; Rapin, D.; Werren, D. W. (Univ. of Geneva). Helv. Phys. Acta; 48: 50-53(1975).

A 576-MeV polarized proton beam used to study the pp → π^+ d reaction for small center of mass π-production angles was studied. The final state π and d were observed using a system of multiwire proportional chambers. The presence of a term in $\cos^4\theta_{CM}$ for the differential cross section was tested. The left-right π production asymmetry for a transversely polarized beam was also measured. (auth)

Strong (Meson-induced)

8339 (CONF-750869--2) NEUTRAL STRANGE PARTICLE PRODUCTION IN pi tau INTERACTIONS AT 250 GeV/c. Bogert, D.; Hanft, R.; Harris, R. (Fermi National Accelerator Lab., Batavia, Ill. (USA); Florida State Univ., Tallahassee (USA)). 1975. 14p. Dep. NTIS $4.50.

From division of particle and fields meeting; Seattle, Washington, USA (Aug 1975).

Neutral strange particles were studied in about one third of a 46,000 picture exposure of 250-GeV/c pions in the Fermilab 15 foot bubble chamber. This chamber is particularly well suited for the study of neutral particles because of its large volume. Experimental inclusive cross sections are sigma (K/sub s/^{0}) equals 4.17 +- 0.45 mb, sigma (LAMBDA^0) equals 1.74 +- 0.24 mb, sigma (anti LAMBDA^0) equals 0.82 +- 0.13 mb. The average number of K/sub s/^{0}, LAMBDA^0, anti LAMBDA^0 per inelastic collision are approximately independent of charge multiplicity. $F_1(x)$ and $F_2(p^2/\text{sub } t/)$ distributions as well as two strange particle mass plots are presented. (auth)

8340 (CONF-750869--3) TOPOLOGICAL CROSS SECTIONS AND MULTIPLICITY MOMENTS FOR π^-p INTERACTIONS AT 250 GeV/c. Hagopian, S.; Albright, J. R.; Hays, P. (Florida State Univ., Tallahassee (USA); Fermi National Accelerator Lab., Batavia, Ill. (USA)). 1975. 14p. Dep. NTIS $4.50.

From division of particle and fields meeting; Seattle, Washington, USA (Aug 1975).

The data are from a 46,000 picture exposure of the 15-foot hydrogen bubble chamber at Fermilab to a 250-GeV/c π^-run. An inelastic cross section of 21.1 +- 0.6 mb was obtained. Topological cross sections and multiplicity moments are presented and compared with results at lower energies. The energy dependence of the mean charged multiplicity, $\langle n \rangle$, and the second moment, f_2, are well fit by a polynomial in log's for π^-p experiment from 10 to 250 GeV/c. (auth)

8341 (FSU-HEP-75-1-03) FOUR CHARGED PARTICLE FINAL STATES FROM THE REACTION π^+d AT 15 GeV/c. Pewitt, N. D. (Florida State Univ., Tallahassee (USA)). Jan 1975. 177p. Dep. NTIS $8.50.

Thesis.

The data from 387,000 stereotriplet photographs of the deuterium filled Stanford Linear Accelerator Center 82-inch bubble chamber exposed to a 15-GeV/c π^+ separated beam is presented. The film was measured on a Flying Spot Digitizer with an accuracy of one micron. The final states $\pi^+\pi^-pp$, $p\pi^+\pi^-p^0pp$, $p\pi^+\pi^+\pi^-np$, $p\pi^+\pi^+\pi^-d$ and $p\pi^+\pi^+\pi^-\pi^0d$ are discussed. With an experimental sensitivity of 4.75 +- .09 events/mu b there is no new boson resonance structure in these data. The one-pion-exchange process dominates the breakup reactions. A rising (3 pi) coherent cross section established by these data is explained in terms of a kinematical effect. The data were used in a search for direct evidence for nuclear isobar (DELTA DELTA) component of the deuteron and established an upper limit at about one per cent. Details of the experimental procedure and the data reduction are described as well as an alternate data processing system, RESURX, which allows human intervention in the pattern recognition process to save over half the events failed by the normal data reduction system. (auth)

8342 (LBL-4299) K^-p AND ANTI pp CHARGE EXCHANGE CROSS SECTIONS BELOW 1.1 GeV/c. Alston-Garnjost, M.; Kenney, R.; Pollard, D.; Ross, R.; Tripp, R.; Nicholson, H.; Ferro-Luzzi, M. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1975. Contract W-7405-eng-48. 7p. (CONF-750858-11). Dep. NTIS $4.50.

From meeting of the ASP division of particles and fields; Seattle, Washington, USA (27 Aug 1975).

The cross sections are measured for K^-p yields anti K^0n at 520 to 1060 MeV/c and for anti pp yields anti nn from 270 to 960 MeV/c with a typical point-to-point precision of about 1 percent. The cross sections in preliminary form are shown and discussed. It is suggested that the spin of the SIGMA(1590) must be at least $^3/_2$ and that of a possible resonance at the bump at 475 MeV/c must be at least 4. (JFP)

8343 SCATTERING OF NEGATIVE K MESONS ON NUCLEONS IN THE MOMENTUM RANGE BETWEEN 0.4 AND 1.9 GeV/c. Putzer, A. K. F. Heidelberg; Univ. Heidelberg (1973). 122p. (In German). INIS.

Thesis.

Total and differential cross sections were determined for the reactions (1) $K^-p \to K^-p$ (2) $\to$ anti K^0n (3) $\to \pi^+\Sigma^-$ (4) $\to \pi^-\Sigma^+$ (5) $\to \pi^0\Lambda$ in a bubble chamber experiment at 20 different impulses of 1.1 to 1.7 GeV/c. Legendre polynomials for the reactions (1) to (5) and associated legendre polynomials for the polarizing angle distributions of the reactions (4) and (5) are adapted to the experimental data. (GE)

8344 TRANSVERSE SPECTRA IN π^+p AND K^-p INTERACTIONS BETWEEN 8 AND 16 GeV/c. Deutschmann, M. pp 43-55 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868--.

Using data from several bubble experiments, the inclusive reactions $\pi^+p \to \pi^- + X$, $K^-p \to \overline{K}^0 + X$ and $K^-p \to \Lambda + X$ at incident momenta ranging from 8 to 16 GeV/c were studied. Single particle spectra are given as functions of the transverse energy $E_\perp = (p_\perp^2 + m^2)^{1/2}$ for selected intervals of the longitudinal rapidity y. Using these two variables a simple, mass independent, representation of all particle spectra is found: Within a large range of y, non-Lorentz-invariant E distributions are nearly exponential and, over several orders of magnitude in cross section, can be fitted well with the single-parameter function $(e^{E_\perp/T} - 1)^{-1}$. The slope parameter T is shown to depend on y but, in the central region, it appears to be independent of the particle mass and gives indications of approaching a limiting value of approximately 120 MeV. Implications of these results with regard to thermodynamic models are briefly discussed. (auth)

8345 P_t DISTRIBUTION IN HADRONIC INTERACTIONS WITH AND WITHOUT BARYON EXCHANGE AROUND 5 GeV CMS ENERGY. Lestienne, R. (Ecole Polytechnique, Paris); Chaurand, B.; Drevillon, B.; Gago, J. M.; Labrosse, G.; Salmeron, R. A.; Barrier, M.; Brandao, M. A.; Nguyen, H. K. pp 56-69 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868--.

A study of the P_t distributions of particles produced in several meson-baryon $\to$ baryon + $\eta\pi$ and baryon-antibaryon $\to n\pi$ reactions is made, using 14.3-GeV/c K^-p, 11.7 GeV/c π^+n, 11 GeV/c π^-p and 3.6- and 5.7-GeV/c pp data. It is found that besides the $\langle p_t \rangle$, also the shapes of the p_t distributions of the secondary pions are different in baryon and nonbaryon exchange processes. A study is made of the p_t of the secondary pions as a function of the p_t of the outgoing baryon. (auth)

8346 VECTOR MESON PRODUCTION IN INCLUSIVE pp REACTIONS AT 12 AND 24 GeV/c. Blobel, V. pp 76-80 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868--.

Inclusive vector meson production in the pp experiment at 12 and 24 GeV/c is studied. The total production cross sections for $\rho(765)$, $\omega(784)$, and K(892) are given and discussed. (JFP)

8347 TWO-PARTICLE DISTRIBUTIONS AND CORRELATIONS IN INCLUSIVE PROCESSES FROM π^-p AT 11 GeV/c. Borzatta, P. (Istituto di Fisica, Milan); Chiaveri, E.; Liotta, L.; Ratti, S.; Daudin, A.; Daronian, P. pp 191-200 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868--.

An experimental study is presented for two-particle reactions from π^-p interactions at 11.2 GeV/c. Inclusive two-particle distributions and the differential correlation functions are shown for $\pi^-p \to (2\pi^-, \pi^-\pi^+, p\pi^+, p\pi^-)$ + anything interactions. Longitudinal, rapidity, and azimuthal correlations, and two-particle distribution and correlation integrals are discussed. (JFP)

8348 RAPIDITY DIFFERENCES OF PRODUCED PARTICLES IN HIGH ENERGY COLLISIONS. Loskiewicz, J. (Univ., Paris). pp 269-275 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868--.

An analysis of multiparticle production data in terms of rapidity differences of final particles is given. An attempt is made to find the characteristic features of collisions in terms of these variables. The reactions π^+n at 5 and 11.7 GeV/c were studied. The rapidities and various distributions are plotted. (JFP)

8349 DETERMINATION OF 3π NUCLEON CROSS SECTION IN $J^P = 0^-$ STATE AND POSSIBLE OMEGA-EXCHANGE IN 3π COHERENT PRODUCTION ON NUCLEI. Bellini, G.; di Corato, M.; Meroni, E.; Palombo, F.; Rancoita, P. G.; Vegni, G. (Univ., Milan). pp 608-616 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868--.

The possible dependence of the absorption from the spin-parity of the coherently produced 3π system is investigated. For this purpose the angular distribution of the normal to the decay plane of the 3π system was studied for about 30,000 coherent events. $\pi^- A \rightarrow 2\pi^-\pi^+ A$ obtained on nine different nuclei at 8.9 and 15.1 GeV/c is investigated. (JFP)

8350 FIRST RESULTS ON PION SCATTERING BY POLARIZED PROTONS AT SIN. Amsler, C. (ETH, Zurich); Perdrisat, C. F.; Weymuth, P.; Dubal, L.; Eaton, G. H.; Frosch, R.; Funk, P.; Gugelot, P. C.; Janett, A.; Mango, S.; Pozar, F. Helv. Phys. Acta; 48: 54-56(1975).

Preliminary measurements were made of the angular dependence of the parameter P in π^+ p elastic scattering at 349 MeV/c incident lab momentum. The differential cross sections were also measured at this energy. (JFP)

Particle Interactions and Properties (Theoretical)

General

Refer also to abstracts 8420 and 8421.

8351 (COO-3065-125) SUGGESTION FOR TESTING THE HYPOTHESIS OF LOCAL COMPENSATION OF TRANSVERSE MOMENTUM. Weingarten, D. (Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). 22 Aug 1975. Contract E(11-1)-3065. 8p. (UR-547). Dep. NTIS $4.50.

An experimental test of the hypothesis of local compensation of transverse momentum in multiparticle production is described. (auth)

8352 (FERMILAB-Conf-75/71-THY) REVIEW OF MODELS WITH MORE THAN FOUR QUARKS. Barnett, R. M. (Fermi National Accelerator Lab., Batavia, Ill. (USA); Harvard Univ., Cambridge, Mass. (USA). Lyman Lab. of Physics). Sep 1975. 34p. (CONF-750842-2). Dep. NTIS $5.00.

From 6th topical conference in particle physics; Honolulu, Hawaii, USA (6 Aug 1975).

Several models with more than four quarks are reviewed and compared with the four-quark model. They generally have right- and left-handed currents and are of the $SU_2 \times U_1$ type. The lepton sectors are also discussed including the possibilities of heavy charged and neutral leptons. The weak phenomenology, triangle anomalies, degenerate quark masses and radial excitations are examined. (auth)

8353 (FERMILAB-Conf-75/72-THY) REVIEW OF GAUGE THEORIES. Lee, B. W. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). Sep 1975. 37p. (CONF-750855-7). Dep. NTIS $5.00.

From international symposium on lepton and photon interactions at high energies; Stanford, California, USA (21 Aug 1975).

A review is given of gauge theories including an outline of two outstanding issues in the theory of nonleptonic weak interactions, a summary of analyses of higher-order weak interactions based on gauge theory, the mass scale set by the fourth quark, model building incorporating V + A currents. Motivations for such enterprises are emphasized. (JFP)

8354 (RL-73-023(Rev.)) ASSESSMENT OF POSSIBLE ENRICHMENT PROCESSES FOR HEAVY METASTABLE CHARGED PARTICLES. Smith, P. F.; Spurway, A. H. (Science Research Council, Chilton (UK). Rutherford Lab.). Oct 1974. 32p. Dep. NTIS (US Sales Only) $5.00.

On the hypothesis that very long-lived charged particles may exist with mass 10 to 200 times the proton mass, they would be expected to be present in ordinary matter in a very low natural or cosmic ray produced concentration, predominantly in the form of heavy hydrogen-like atoms. The possibility is discussed of increasing this concentration to a level which would allow experimental detection, using techniques analogous to those employed for the separation of the known hydrogen isotopes. It is found that the modified physical properties of compounds containing the hypothetical heavy atoms can be predicted from those containing hydrogen, deuterium and tritium, with sufficient confidence to demonstrate that such heavy atoms would be present in the output of typical heavy water production routes with a factor 10^4 — 10^5 increased concentration. By further processing of, for example, a 10,000 litre quantity of heavy water, overall enrichment factors in the region 10^{11} to 10^{13} could be achieved for final sample volumes in the region 1 ml to 0.001 ml. The relative merits of a number of possible enrichment techniques are discussed. (auth)

8355 (RL-75-113) BUILDING UP REGGEONS AND THE POMERON FROM DUALITY AND UNITARITY. Sakai, N. (Science Research Council, Chilton (UK). Rutherford Lab.). Jul 1975. 12p. (CONF-750654-12). Dep. NTIS (US Sales Only) $4.00.

From high energy particle physics divisional conference of EPS; Palermo, Italy (23 Jun 1975).

In two-body interactions the hadron amplitude is given by a sum of a Regge-resonance and a Pomeron background part. The former is discussed in the context of duality and the latter in conjunction with unitarity. These concepts are developed and prospects and problems are considered. (SDF)

8356 SINGLE PARTICLE DISTRIBUTIONS AT HIGH ENERGIES. Sens, J. C. (Foundation for Fundamental Research on Matter, Netherlands). pp 9-42 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

A very elementary introduction is given to the subject of inclusive interactions and the language currently used to interpret single particle data. Also some recent ISR results are included. (JFP)

8357 CORRELATIONS IN PARTICLE PRODUCTION AT HIGH ENERGIES. Bialas, A. (CERN, Geneva). pp 93-139 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The question of how the fact of finding a given group of particles in an interaction influences the expectation of finding other particles in the same interaction is studied from the correlations between particles produced in high energy collisions. The predictions of models for correlations among particles is mainly discussed. Inclusive and exclusive correlations, experimental data, general asymptotic arguments, models, and charge correlations are considered. (JFP)

8358 CORRELATIONS IN EXCLUSIVE REACTIONS. Humble, S. (Daresbury NPL, Eng.). pp 276-281 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The usefulness of a study of correlations in exclusive reactions as compared with inclusive studies is discussed including the global view of correlations as functions of n and s and a microscopic view of correlations in an n-body final state. (JFP)

8359 CHARGE TRANSFER DISTRIBUTIONS IN HIGH ENERGY PROCESSES: INTERPRETATION. Fialkowski, K. (Jagiellonian Univ., Krakow). pp 290-295 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The data on charge transfer in inclusive processes is discussed. An attempt is made to show that the measurements of charge distributions may provide a useful tool for investigation of correlation properties. Existing data on the distribution of charge transfer between the initial and final cm hemispheres is used. The investigation of charge transfer appears to be a useful way to fix the details of models used to describe the correlations between momenta of produced particles. (JFP)

8360 DUALITY AND MULTIPARTICLE PRODUCTION. Veneziano, G. (Weizmann Inst. of Sciences, Rehovot, Israel). pp 325-335 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

A simple way to correct dual models for lack of unitarity in such a way as to obtain unambiguous results for multiparticle production at high energy is considered. Unitarized dual production amplitudes, exclusive and inclusive analyses, the reason for the Pomeron intercept being one, and the outlook and relation to other theories are discussed. (JFP)

8361 TRANSVERSE MOMENTA AT x = 0 IN A PHENOMENOLOGICAL DUAL MODEL FOR DOUBLE POMERON EXCHANGE.

Bebel, D.; Biebl, K. J. (Humboldt-Univ., Berlin). pp 336-343 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

A summary is given of some results recently obtained from attempts to understand the characteristic features (exponentially linear behavior at small $p_\perp$ and flattening off at large $p_\perp$) of the inclusive single particle distributions at $x = 0$ measured at ISR energies on the basic of the parton and multiperipheral models. There was also an attempt to describe these distributions in the framework of a phenomenological dual model for double Pomeron exchange. (JFP)

8362 MULTIPLICITY SCALING. Olesen, P. (Niels Bohr Inst., Copenhagen). pp 463-481 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The discussion of multiplicity scaling includes difinitions of this term, comparison with experiment, and models. It is noted that there is still a long way to go before one possibly understands multiplicity scaling, the models merely serve as a guide for new developments. It is not believed that multiplicity distributions can provide much fundamental understanding of strong interaction physics. (JFP)

8363 INELASTIC SHADOW EFFECTS AND DIFFRACTIVE DISSOCIATION. Bialas, A. (Jagellonian Univ., Krakow); Kotanski, A. pp 511-516 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The method of overlap matrix is used for calculation of diffractive dissociation in the uncorrelated jet model. The properties of the exclusive and inclusive diffractive spectra are discussed. The model can account for general features of the data. (auth)

8364 METHOD FOR HANDLING MULTIPERIPHERAL MODELS. Marchesini, G. (Univ., Parma, Italy). pp 534-537 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

Attention is given to inclusive correlation functions, and their properties studied on the basis of J-plane singularities of the two-body amplitude within multiperipheral models. The program is similar to the Regge-Mueller theory. Also studied are the total cross section, the effect of clustering, and short-range correlations. (JFP)

8365 STIMULATED EMISSION EFFECT ON MULTIPLICITY DISTRIBUTION. Giovannini, A. (Univ., Turin); Nielsen, H. B. pp 538-542 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The question of whether the interference effect has some influence on the multiplicity distribution is discussed. It is found that the model in its present form does not allow one to explain positive correlations between neutral and charged particles, but topological cross sections and multiplicity moments are predicted in fairly good agreement with experiment. (JFP)

8366 GENERALIZED OPTICAL DESCRIPTION OF FEW-BODY REACTIONS. Humble, S. (Daresbury Nuclear Physics Lab., Eng.). pp 558-563 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The impact parameter description of two-body reactions is generalized to few-body production reactions. For the three particle process $a + b \to c_1 + c_2 + c_3$ two impact parameter profiles are introduced; one corresponding to the pseudo two-body reaction $a + b \to (c_1 + c_2) + c_3$, and a second profile determining the dominant angular momentum states of the $c_1 + c_2$ system. In this way it is shown how the production amplitude can be parameterized to take account of external particle spin, possible Regge exchanges and absorptive effects at large sub-energies, and resonance structures at low sub-energies. An analysis of the diffraction dissociation distributions for the process $N\pi \to N_1\pi_2\pi_3$ in terms of this model indicates that the pseudo two-body diffractive process $N\pi \to (N_1\pi_3) + \pi_2$ proceeds via an impact parameter profile centered around one fermi, but the final state $N_1\pi_3$ system is observed to give rise to a much more central interaction. A connection between this model and the Faddeev description of few-body reactions is suggested. (auth)

8367 NEW PERSPECTIVES IN MULTIPARTICLE REACTIONS. Wroblewski, A. (Univ., Warsaw). pp 625-676 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

A personal judgement on the past, current, and future prospects for multiparticle physics is presented. An historical review, the problem of clusters, the KNO scaling, neutral pion production, the basic features of hadron collisions, and the near and far future of this field are covered. (JFP)

8368 NEW MATHEMATICAL FRAMEWORK FOR FUNDAMENTAL THEORETICAL PHYSICS. Var, R. E. (Charles Stark Draper Lab., Inc., Cambridge, MA). Found. Phys.; 5: No. 3, 407-431(Sep 1975).

It is shown by means of general principles and specific examples that, contrary to a long-standing misconception, the modern mathematical physics of compressible fluid dynamics provides a generally consistent and efficient language for describing many seemingly fundamental physical phenomena. It is shown to be appropriate for describing electric and gravitational force fields, the quantized structure of charged elementary particles, the speed of light propagation, relativistic phenomena, the inertia of matter, the expansion of the universe, and the physical nature of time. New avenues and opportunities for fundamental theoretical research are thereby illuminated. (auth)

8369 LOCAL CURRENTS AND THEIR APPLICATIONS. Proceedings of a Conference Held at Princeton, New Jersey, October 8-10, 1971. Sharp, D. H.; Wightman, A. S. Amsterdam; North-Holland Publishing Company (1974). 177p. (CONF-711088). $12.50.

Abstracts of the eight papers presented appeared previously in NSA with abstract numbers: 32:12951, 32:12952, 32:12953, 32:12954, 32:12955, 32:12956, 32:12957, 32:12958. (JFP)

8370 ASYMPTOTIC EQUALITY OF DIFFERENTIAL CROSS SECTIONS IN THE FORM OF DIFFERENCE. Medvedev, S. Yu. (Inst. of Theoretical Physics, Uzhgorod, USSR). Teor. Mat. Fiz.; 23: No. 1, 140-143(Apr 1975). (In Russian).

Estimates are obtained for the decreasing rate of the difference of differential cross sections of the direct and cross reactions under the various restrictions imposed on the phase of the antisymmetric part of the amplitudes of these reactions. (auth)

Electromagnetic

Refer also to abstracts 8633 and 8648.

8371 (COO-2171-54) RADIATIVE PION-PROTON SCATTERING IN THE STATIC CHEW-LOW MODEL. Ho-Kim, Q.; Lavine, J. P. (Laval Univ., Quebec City (Canada). Dept. de Physique; Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). 1975. 12p. Dep. NTIS $4.50.

The results of a nonrelativistic calculation of pi/sup +-/-proton bremsstrahlung cross sections at the pion laboratory kinetic energy of 298 MeV for backward photon angles is presented. The pi p interaction is described by the static Chew-Low model. (auth)

8372 (DESY-75/18) OFF-DIAGONAL GENERALIZED VECTOR DOMINANCE. A Comparison with Recent ep Deep Inelastic Data. Devenish, R.; Schildknecht, D. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Jul 1975. 10p. (AED-CONF-75-343-001). INIS.

From international symposium on lepton and photon interactions at high energies; Stanford, Calif. (21 Aug 1975).

4 figs.; 8 refs. With abstract.

The predictions of a recently suggested generalized vector dominance model, which includes off-diagonal terms, are compared with 4^0 deep inelastic ep scattering data. (auth)

8373 RELYATIVISTSKIY ELEKTRON. (Relativistic Electron). Sokolov, A. A.; Ternov, I. M. Moscow; Izdatel'stvo Nauka (1974). 392p.

A discussion is given of the classical and quantum theory of motion and radiation of relativistic electrons. A study is made

of a number of urgent problems, for example, the exact solution of certain radiation problems by classical electrodynamics, the study of the classical Dirac-Lorenz relativistic equation considering the force of radiation friction, and so on. All of this has, in particular, in recent times found broad practical application not only in the description of microprocesses but also in the investigation of the motion of an ultrarelativistic electron along trajectories with a macroscopic radius of curvature (for example, the synchrotron radiation). A special role is assigned to the analysis of such problems using the relativistic quantum equation inasmuch as without considering quantum effects it would be impossible to design and build modern electron cyclic accelerators and storage elements. (auth)

8374 REMARKS ON INCLUSIVE PROCESSES AT HIGH TRANSVERSE MOMENTUM. Gunion, J. F. (Univ. of Pittsburgh). pp 355-371 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The main emphasis for the discussion of inclusive processes at high transverse momenta is placed on certain phenomenological implications of interchange theory. The primary assumption is that hadrons are composed of pointlike field-theoretical constituents (partons). The processes pp, πp, γp, and $\gamma\pi$ are considered. (JFP)

8375 SPIN MAGNETIC MOMENT OF A FREE RELATIVISTIC ELECTRON. Chow, T. L. (California State Coll., Turlock). Found. Phys.; 5: No. 3, 453-454(Sep 1975).

By decomposing the charge-current density, it is demonstrated that the "built-in" spin magnetic moment of a free relativistic electron is $c\hbar/2mc$, where m is the Lorentz mass. (auth)

8376 ELECTRODYNAMICS IN TERMS OF FUNCTIONS OVER THE GROUP SU(2). I. The Equation of the Vector Potential. Barut, A. O. (Univ. of Colorado, Boulder; Malin, S. Found. Phys.; 5: No. 3, 375-386(Sep 1975).

A method of harmonic analysis in terms of functions over the group SU(2) is applied to the description of interaction between matter and the electromagnetic field. Carmeli's SU(2) formulation of Maxwell's equations is extended to an SU(2) formulation of the equations for the electromagnetic vector potential. The four functions which describe the vector potential are expanded in a generalized Fourier series [SU(2) harmonic analysis] and the equations for the coefficients are derived. These equations are not independent of each other, but in a given order they can be solved consecutively one at a time. (auth)

8377 MODIFIED SOMMERFELD-MAUE WAVE FUNCTION: APPLICATION TO THE PAIR-PRODUCTION PROCESS. Roche, G.; Jousset, J. (Univ., Clermont, Aubiere, France). Phys. Rev., A; 12: No. 2, 531-538(Aug 1975).

A solution of the Dirac equation for an electron in a point-Coulomb potential is given in the form of an expansion in the parameter $1/r$. The main part of the solution is the Sommerfeld-Maue wave function. One introduces a correction term. All orders in α Z are kept. The given solution (Sommerfeld-Maue plus correction term) contains the exact contributions of orders 0 and 1 in the expansion in $1/r$. This modified Sommerfeld-Maue wave function is used to get the cross section for the pair-production process by γ rays in the field of a nucleus. The cross section is written in the form of the Fink-Pratt cross section plus a correction term. The formula is valid for all α Z. The energetic relative accuracy should be of order $1/E^2$. The small-angle approximation is not introduced. (auth)

8378 SELF-CONSISTENT MODEL FOR THE PRODUCTION OF CHARGED PARTICLES. Mas-Parareda, A.; Urban, P. (Univ., Graz). Acta Phys. Austriaca; 39: No. 3, 220-242(1974).

An absorptive multiperipheral model for multiparticle production, which is consistent with the unitarity condition is presented. An optical model is proposed for the elements of the multiperipheral amplitude. Combining elastic and charge-exchange amplitudes as in the A model of Chew-Pignotti it is possible to calculate the contribution to the cross section. In addition one takes into account absorptive effects, which introduce the usual factor $S^{\frac{1}{2}}$. For large energies one achieves a bootstrap for the elastic amplitude. One calculates the multiplicity distribution of charged particles which form an isospin triplet for large energy and explicitly give the correlation parameters f_{3-}, f_{5-}. One investigates also the correlation between neutral and negative particles. (auth)

8379 PHYSICAL SIGNIFICANCE OF THE RICCATI DIFFERENTIAL EQUATION: RELATIVISTIC SPIN PRECESSION. Urbantke, H. (Univ., Vienna). Acta Phys. Austriaca; 39: No. 3, 250-254(1974). (In German).

The well known Riccati equation is shown to describe the precession of spin of a charged particle moving in an external electromagnetic field, if its g-factor = 2. (auth)

8380 THEORY OF ELASTIC SCATTERING OF FAST PARTICLES IN THE QUASICLASSICAL APPROXIMATION. Akhiezer, A. I.; Boldyshev, V. F.; Shul'ga, N. F. (Physical-Technical Inst., Kazan, USSR). Teor. Mat. Fiz.; 23: No. 1, 11-21(Apr 1975). (In Russian).

The quasiclassical solution of the Dirac equation for a fast electron in the external static field is discussed. The correspondence between the Born, eikonal and quasiclassical approximations and the Furry-Sommerfeld-Maue approximation is clarified. The amplitude of the elastic scattering of electrons (positrons) at small scattering angles is evaluated. The conditions are found, under which the quasiclassical amplitude leads to the results of classical mechanics and to the results of quantum-mechanical perturbation theory. Elastic scattering of fast particles by the chain of atoms is considered. (auth)

Weak

Refer also to abstract 8167.

8381 (COO-1428-426) COMPARISON OF nu p AND nu n INCLUSIVE CHARGED-CURRENT REACTIONS BELOW 6 GeV. Garfinkel, A. F. (Purdue Univ., Lafayette, Ind. (USA)). 1975. 3p. (CONF-750858-9). Dep. NTIS $4.50.

From meeting of the ASP division of particles and fields; Seattle, Washington, USA (27 Aug 1975).

An analysis of inclusive charged-current nu interactions in the Argonne National Laboratory 12-foot bubble chamber by the ANL-Purdue collaboration shows evidence for parton composition of the nucleon when E/sub nu/ greater than 2 GeV. The ratio of neutron to proton total cross sections is measured to be 1.40 ± 0.31 in this energy region. (auth)

8382 STUDY OF NEUTRAL CURRENT. Kim, J. E. Rochester, NY; Univ. of Rochester (1975). 190p. University Microfilms Order No. 75-22,747.

Thesis (Ph.D.).

It is suggested that the neutral hadronic current should transform as a U-spin scalar. One is led to this proposition from considerations of generalized Cabibbo rotation, coupled with the lack of strangeness changing neutral hadronic currents as required by the extremely small branching ratios observed for certain decays. A specific model for the semileptonic interaction of neutrinos and hadrons is written down in terms of the U-spin invariant, neutral, hadronic, vector and axial-vector current structures. The model is analyzed using presently available neutral current data from inelastic neutrino scattering, weak pi production and the elastic neutrino-proton scattering. The neutral current data are also used to place upper bounds on the electromagnetic properties of the muonic neutrino. Also calculations of the charge radius and the magnetic moment of the neutrino (possible only if the neutrino is not massless) based on suitable gauge theory models are presented. Unlike similar calculations based on the conventional "V-A" theory, the present results are finite, a special feature of the renormalizable gauge theories. The calculated results of the electromagnetic properties suggest that the neutral current phenomenon involving neutrinos cannot be explained merely on the basis of electromagnetic interactions. Finally, a special gauge theory model is investigated which effectively leads to the general U-spin invariant structure for the weak neutral current assumed in the phenomenological analysis. (Diss. Abstr. Int., B)

8383 DIFFRACTION DISSOCIATION IN p-p INTERACTIONS AT 205 GeV/c. Hyman, L. (Argonne National Lab., IL). pp 573-579 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

A report is given on diffraction dissociation in pp interactions at 205 GeV/c based on an analysis of low multiplicity events from 205 GeV pp interactions using both the missing mass spectrum from the slow proton in two and four charged particle final states and also measurement of all the tracks in the events. The missing mass distribution and the cross sections are shown. Evidence for Δ^{2+} (1236) is found. (JFP)

8384 WEAK DECAYS INVOLVING LEPTONS. Pietschmann, H. (Univ., Vienna). Acta Phys. Austriaca; 39: No. 4, 355-384(1974).

The discussion of weak decays involving leptons covers the theoretical model, muon decay, tests of the structure of the S operator, double β decay, description of a general baryon decay,

lifetime and μ - e ratio, first- and second-class currents, consequences of CVC for $\Delta Y = 0$ processes, Cabibbo's assumptions, phenomenology of semi-leptonic meson decays, P_{l2} decays, P_{l3} decays, and models for higher orders. (JFP)

8385 GAUGE THEORY OF THE CABIBBO ANGLE. Kuang, Y. P.; Ma, C. C.; Hsu, P. W.; I, Y. P. (Lanchow Univ., China). Wu Li Hsueh Pao; 24: No. 4, 291-300(Jul 1975). (In Chinese)

From a study on the relation between the strong action symmetry and the weak-electromagnetic action symmetry in the uniform gauge theory, a theoretical explanation of the Cabibbo angle under the nonleptonic symmetry condition of $SU(2) \times SU(2) \times U(1)$ is given, and a numerical value is obtained for the Cabibbo angle of $\theta = \tan^{-1}(2 - \sqrt{3}) \sim 0.262$. (auth)

Strong (General)

8386 (ANL/HEP-CP-75-52) DIFFRACTIVE PROCESSES. Derrick, M. (Argonne National Lab., Ill. (USA)). 1975. 44p. (CONF-750858-10). Dep. NTIS $5.00.

From meeting of the ASP division of particles and fields; Seattle, Washington, USA (27 Aug 1975).

Recent results on elastic scattering of hadrons, single and double inelastic diffraction, and double Pomeron exchange are reviewed. Comments are made on features of the data that can be simply understood using optical models or the triple Regge model. (auth)

8387 (COO-2271-53B) HIGH ENERGY HADRON-NUCLEUS SCATTERING. Koplik, J.; Mueller, A. H. (Columbia Univ., New York (USA). Dept. of Physics). 1975. 7p. Dep. NTIS $4.50.

Theoretical expectations for hadron-nucleus scattering at high energy if the basic hadron-hadron interaction is due to Regge poles and cuts arising in multiperipheral or soft field theory models are described. Experiments at Fermilab may provide a critical test of such models. (auth)

8388 PROCEEDINGS OF THE IV INTERNATIONAL SYMPOSIUM ON MULTIPARTICLE HADRODYNAMICS, PAVIA, ITALY, AUGUST 31-SEPTEMBER 4, 1973. Duminio, F.; Giovannini, A.; Ratti, S. (eds.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973). 691p. (CONF-730868-).

Separate abstracts were prepared for the 56 papers presented. (JFP)

For abstracts of individual papers see: 7388, 8323, 8324, 8328-8336, 8344-8349, 8356-8367, 8374, 8383, 8389-8391, 8393-8395, 8398-8407, 8411-8416, 8424, and 8425.

8389 STATISTICAL BOOTSTRAP MODEL AND PARTICLE PRODUCTION VIA MULTIFIREBALL PRODUCTION. Ranft, J.; Ranft, G. (Karl Marx-Univ., Leipzig). pp 482-500 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

Some recent developments in the statistical bootstrap model and the application of the fireballs as described in this model for the phenomenology of particle production in hadron-hadron collisions are described. In the multifireball production model, the fireballs are produced in a multiperipheral (and diffractive) way. In the second step the fireballs decay according to the statistical bootstrap model. (JFP)

8390 MULTIPLICITY MOMENTS AT LOW AND HIGH ENERGY IN HADRON-HADRON SCATTERING. Antich, P. (Univ., Pavia, Italy); Calligarich, E.; Cecchet, G.; Dolfini, R.; Impellizzeri, F.; Ratti, S.; Giovannini, A. pp 543-552 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

A phenomenological investigation is made of the relation obtained previously for the C_q moments. Some comments are made on the results for hadron interactions. (JFP)

8391 NEW RENORMALIZABLE EIKONAL PERTURBATION THEORY HAVING APPLICATIONS IN HADRON DYNAMICS. Orzalesi, C. A. (Univ., Parma, Italy). pp 564-570 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

A field-theoretic laboratory is outlined for investigating problems and ideas in hadron dynamics. The main tool of this laboratory is a new eikonal perturbation expansion in Lagrangian quantum field theory. (auth)

Strong (Baryon No. = 0)

8392 CHIRAL SYMMETRY PROJECTIONS ON NUL PLANES. Sazdjian, H. Orsay, France; Universite de Paris-Sud (1975). 143p. (In French)

The possibility of describing the hadronic world by field theories on nul planes constructed from three fundamental fields of interacting quarks is suggested. This would also allow the construction of states with a given number of constituents. An attempt is made to find possible expressions for certain observables in terms of quark fields, by means of their transformation properties in relation to $SU(3) \times SU(3)$ light-like charge algebra. A particular method is proposed allowing one to rely on the transformation laws for properties of the observed meson spectra. (JFP)

8393 CROSS SECTIONS AND MULTIPLICITY DISTRIBUTIONS FOR $p\bar{p}$ ANNIHILATIONS AT 4.6 GeV/c. Fry, J. (Univ. of Liverpool). pp 70-75 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The discussion of $p\bar{p}$ annihilations at 4.6 GeV/c includes multiplicities, the interpretation of the cross sections, and scaling in multiplicity distributions. (JFP)

8394 FRAGMENTATION $p(\bar{p})$ $\bar{p}(p)$ $\Delta(\bar{\Delta})$ IN 9.2 GeV/c ANTIPROTON-PROTON REACTIONS. Gregory, P. (Univ. of Liverpool); Mason, P.; Muirhead, H.; Warren, G.; Carlsson, R.; Ekspong, G.; Holmgren, S. O.; Nilsson, S.; Stenbacka, R.; Walck, C. pp 81-87 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The discussion of $p\bar{p} \rightarrow \Delta\bar{\Delta}$ fragmentation covers the cross sections, effective trajectory, and the effectiveness of the triple-Regge pole expansion and diffraction dissociation model. (JFP)

8395 NEUTRAL PION PRODUCTION IN HIGH ENERGY PION-PROTON COLLISIONS. Sosnowski, R. (Inst. for Nuclear Research, Warsaw). pp 299-301 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

Data on π^0 production in pion-proton interactions at 16 GeV/c and in π^-p and π^-n interactions at 40 GeV/c are presented. The particle numbers and distribution are plotted. Also an attempt is made to explain the observed behavior of the π^0 production by assuming the isospin independence model. (JFP)

Strong (Baryon No. = 1)

8396 (COO-1428-424) pi^-p BACKWARD ELASTIC SCATTERING IN THE 5 GeV/c REGION. Dixon, R. L.; Fletcher, J. M.; Garfinkel, A. F.; Loeffler, F. J.; Mudrak, S.; Shibata, E. I.; Stanfield, K. C.; Tang, Y. W.; Hoffman, E. W. (Argonne National Lab., Ill. (USA)). [nd]. 18p. (CONF-750729-5). Dep. NTIS $4.50.

From new directions in hadron spectroscopy meeting; Argonne, Illinois, USA (7 Jul 1975).

Preliminary results are reported for pi^-p yields $p\,pi^-$ differential cross sections at six beam momenta between 4.75 and 5.2 GeV/c for 0 greater than u greater than -0.7 $(GeV/c)^2$. These data are discussed in terms of the possible existence of narrow structure in the center-of-mass energy dependence as would be exhibited by an Ericson fluctuation or a narrow pion-nucleon resonance. (auth)

8397 (FERMILAB-Conf-75/79-THY) WHY ARE HYPERONS INTERESTING AND DIFFERENT FROM NONSTRANGE BARYONS. Lipkin, H. J. (Weizmann Inst. of Science, Rehovoth (Israel); Argonne National Lab., Ill. (USA); Fermi National Accelerator Lab., Batavia, Ill. (USA)). Oct 1975. 21p. (CONF-70858-13). Dep. NTIS $4.50.

From meeting of the ASP division of particles and fields; Seattle, Washington, USA (27 Aug 1975).

The discussion of hyperons covers the necessity of having hyperons, strangeness, charm, and all that, strangeness effects in hadron total cross sections, spin–isospin structure in hyperons, a detailed analysis of strangeness-exchange couplings, and non-leptonic tonic. (JFP)

8398 EXCHANGE MECHANISMS IN FEW-BODY REACTIONS. Martin, A. D. (CERN, Geneva). pp 203-243 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

Exchange mechanisms in high energy reactions of the type $a + b \rightarrow c + d + e$ are discussed, using as an example the reaction $\pi^-p \rightarrow (\pi^-\pi^+)n$ for which high statistics data exist. A comparison is made of the $\pi^-\pi^+$ production amplitudes and of the exchange mechanisms in the ρ and f mass regions. Recent applications of duality to describe resonance production in such reactions are discussed. (auth)

8399 ISOSPIN ANALYSIS IN πp AND pp REACTIONS. Boeckmann, K. (Physikalisches Institut, Bonn). pp 311-321 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

Isospin analyses of the reactions $\pi^d + p \rightarrow \pi(N\pi)$ at 8 and 16 GeV/c and $pp \rightarrow N(N\pi)$ at 12 and 24 GeV/c are presented. The main objective is a study of the broad mass enhancement observed between 1.2 and 1.7 GeV of the $(N\pi)$ system with $I = \frac{1}{2}$ due to isospin zero exchange. (JFP)

8400 LIGHT CONE AND MASS SHELL VARIABLES FOR DATA PRESENTATION. Antich, P.; Caligarich, E.; Cecchet, G.; Dolfini, R.; Impellizzeri, F.; Liotta, L.; Ratti, S. (Instituto Nazionale di Fisica Nucleare, Milan). pp 380-387 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

A two-dimensional representation of high energy data is discussed in terms of energy and longitudinal momentum of the final state particles. The transverse mass and the distance measured along the transverse mass shell are defined as the mass shell coordinates. The use of these variables to investigate correlations between longitudinal and transverse variables is proposed, and the method illustrated by showing the distributions obtained for the outgoing π^- in a π^-p inclusive experiment. (auth)

8401 PRISM PLOT ANALYSIS OF THE REACTION $K^+p \rightarrow K^0p\pi^+$. Yamdagni, N. (CERN, Geneva). pp 388-396 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

Multidimensional analysis of the reaction $K^+p \rightarrow K^0p\pi^+$ is made using the technique of "prism plot" analysis. The analysis separates the reaction channels $K^{*+}(890)p$, $K^{*+}(1420)p$, and $K^0\Delta^{2+}(1236)$. The production and decay angular distributions for the selected samples show characteristics of K^* production dominated by vector-meson exchange and Δ^{2+} production via magnetic dipole ρ-exchange. (auth)

8402 PRISM PLOT ANALYSIS OF THE FOUR-BODY REACTION AT 3.93 GeV/c. Ferrando, A.; Chaloupka, V.; Losty, M.; Montanet, L.; Paul, E.; Yaffe, D.; Zieminski, A. (CERN, Geneva). pp 397-412 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

An analysis of 20,000 events corresponding to the four-body reaction $\pi^-p \rightarrow p\pi^+\pi^-\pi^-$ at 3.93 GeV/c using a complete set of seven variables necessary to specify such a reaction is presented. The choice of the variables and the method adopted are those of the "MIT prism plot analysis". The distribution of the events over the competing channels is determined, and the residual contamination is estimated. In addition the analyzing power of the prism plot method is studied in more detail for two "well known" channels: p A_2^- and $\Delta^0\zeta^0$. (auth)

8403 PRISM PLOT ANALYSIS OF THE REACTION $\pi^+p \rightarrow p\pi^+\pi^+\pi^-$ AT 11.7 GeV/c. Schlatter, W. D. (Univ., Hamburg). pp 413-420 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

The results of the separation of different channels in the reaction $\pi^+p \rightarrow \pi^+p\pi^+\pi^-$ at 11.7 GeV/c using the prism plot analysis are given. Various meson resonances and the $\Delta(1236)$ were found. Total and differential cross sections and mass distributions are found. (JFP)

8404 SOME REMARKS ON THE WEIGHTING FACTOR IN THE LPS FORMALISM. Bossen, G. J. (Univ., Bonn). pp 421-438 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

The behavior of the weighting factor, which eliminates the kinematics influence on the distributions in the longitudinal phase space representation, is calculated for the reaction $\pi^+p \rightarrow \pi^+p\pi^+\pi^-$ at incoming momenta from 5 to 70 GeV/c assuming constant longitudinal mass of the outgoing particles. The results are compared to experimental data at 5, 8, and 16 GeV/c. (auth)

8405 MULTI-DIMENSIONAL ANALYSIS AND PARAMETRIC FITTING IN FEW-BODY HADRON COLLISIONS. Van Hove, L. (CERN, Geneva). pp 439-444 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

The prism plot analysis with analytic functions is applied to the reaction $K^-p \rightarrow K^0\pi^-p$. As a first result, it is found that a graph containing Δ^0 production on the lower vertex is definitely needed. (JFP)

8406 COMMENT ON THE DUAL PROPERTIES OF STRANGENESS ANNIHILATION PROCESSES. Miettinen, H. I. (CERN, Geneva). pp 529-533 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

Some brief comments are made on the inclusive process $K^+ + p \rightarrow \Lambda + X$ and the semi-inclusive process $K^- + p \rightarrow \Lambda +$ pions. The theoretical implications of the observations that in the energy range 5 to 10 GeV/c and in the proton fragmentation region the former process is dominated by the semi-inclusive sub-process, the inclusive cross section of these processes increase rapidly with increasing energy and the cross sections of these processes are much larger than those of the corresponding processes induced by other types of beams are discussed. (JFP)

8407 DIFFRACTION DISSOCIATION AS CLUSTER PRODUCTION. Van Hove, L. (CERN, Geneva). pp 580-581 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

It is shown that the cluster concept can be useful in explaining the remarkably fast drop of the mass spectrum of the dissociated proton occurring soon beyond its maximum, both in the two-particle dissociation $\pi^-p \rightarrow \pi^-(\pi N)$ and in the three-particle dissociation $\pi^-p \rightarrow \pi^-(2\pi N)$. The proposed explanation is to consider diffraction dissociation as a two-step process. (JFP)

8408 CHARGE-INDEPENDENT ANALYSIS OF LOW ENERGY πN SCATTERING DATA. Zimmermann, H. (Univ., Zurich). Helv. Phys. Acta; 48: No. 2, 191-217 (25 Aug 1975).

The determination of charge-independent phase shifts from low energy hadron–hadron scattering data is investigated. For a many-channel system at low energies a simple formulation of a well known method is presented, which allows one to calculate an isospin-mixing matrix and the phase shift corrections due to both the electromagnetic interaction and the electromagnetic mass differences. A potential model is used together with a relativistically modified Schroedinger equation. In the case of the πN system, explicit formulas are derived for the phase shift corrections and the mixing parameter. It results that a charge-independent phase shift analysis is only possible by including not just the Coulomb corrections but also the electromagnetic mass difference corrections. The results of such an analysis are presented. (auth)

8409 BARYON DECIMET MASS SPLITTINGS. Lichtenberg, D. B. (Indiana Univ., Bloomington). pp 379-391 of Proceedings of the Ninth Balaton Symposium on Particle Physics High Energy Hadron Interactions. Vol. I. Bloomington, IN; University of Indiana (1975).

From 9th Balaton symposium on particle physics high energy hadron interactions; Budapest, Hungary (1975).

According to the Gell-Mann-Okubo mass formula, the masses of the members of the baryon decimet should obey an equal-spacing rule. Because the DELTA and SIGMA* members of the decimet are broad resonances, there is a difficulty in deciding what their masses are. The experimental data and the question of interpretation are discussed. It is concluded that the present difficulty is more a problem of theoretical interpretation than of inadequate data. If the mass and width of a resonance are defined in terms of the position of the pole of the S matrix in the complex energy plane, then the equal-spacing rule is not well satisfied, but the weaker sum rule M/sub OMEGA/ - M/sub DELTA/ equals 3(M/sub XI*/-M/sub SIGMA*/ holds quite accurately. This latter sum rule follows in second-order perturbation theory from the assumption that the mass operator transforms like an SU(3) singlet-plus-octet. (auth)

Strong (Baryon No. ≥ 2)

8410 (COO-1428-429) STUDY OF NUCLEAR FRAGMENT EMISSION IN PROTON HEAVY NUCLEUS COLLISION FROM 10 TO 500 GeV/c. (Fermi National Accelerator Lab., Batavia, Ill. (USA); Reaction Motors, Inc., Denville, N. J. (USA)). 16 Sep 1975. 9p. (PU-75-425). Dep. NTIS $4.50.

We propose to measure the double differential cross section of nuclear fragments (2 less than or equal to Z less than or equal to 16), for a given incident momentum, produced by proton heavy nucleus (20 less than or equal to Z less than or equal to 80) collisions in the 10 to 500 GeV/c momentum range. Recent experimental results and theoretical speculations suggest collective nuclear motion is initiated by the passage of a fast proton through a heavy nucleus. The novel feature of this experiment is the determination of the energy dependence of the excitation mechanism. Because nuclear fragments are best studied from thin targets, one needs a very high beam flux to obtain sufficient event rates. These considerations make the Internal Target Area with a heavy gas jet target the ideal place to initiate our experimental program. The detection system will consist of four conventional DELTA E-E semiconductor telescopes. (auth)

8411 RISE OF TOTAL CROSS SECTIONS AND ITS IMPLICATIONS. Cheng, H. (Massachusetts Inst. of Tech., Cambridge). pp 445-460 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The reasoning behind the conclusion that the total cross section for hadron scattering must rise is explained. One begins with the study of the scattering amplitude in quantum electrodynamics. Proton-proton interactions are considered. (JFP)

8412 CROSS SECTION AND MULTIPLICITY DISTRIBUTION IN THE TWO-COMPONENT MODEL. Roberts, R. G.; Roy, D. P. (Rutherford High Energy Lab., Chilton, Eng.). pp 503-510 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

From a discussion of total cross section and multiplicity distributions in the two-component model, it is concluded that it is extremely hard to estimate the increase of diffractive cross section directly from the data. It seems at least plausible that the diffraction part accounts for the bulk if not all of the cross section rise. (JFP)

8413 DIFFRACTIVE PARTICLE PRODUCTION AND ANISOTROPIC FIREBALL MODEL. Ranft, G.; Ranft, J. (Karl-Marx-Univ., Leipzig). pp 553-557 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

The anisotropic fireball model for diffractive particle production in pp interactions is discussed with two kinds of fireballs considered: H type fireballs (which have hydrodynamic decay properties and do not have scaling) and Q-type fireballs, which correspond to the multiperipheral thermodynamics model and have scaling. It is concluded that the anisotropic decay according to the H type as well as the Q type mechanism gives a good description of the diffractive component. The data rule out isotropic fireball decay. (JFP)

8414 TWO-BODY CORRELATIONS AT THE NAL-ISR ENERGIES. Miettinen, H. I. (CERN, Geneva). pp 582-596 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

Rapidity correlation between two charged and charged and neutral particles in pp interactions are studied and the experimental results interpreted. (JFP)

8415 NON FACTORIZED MUELLER SINGULARITIES AND PHENOMENOLOGICAL CONSEQUENCES IN INCLUSIVE DISTRIBUTIONS. Bassetto, A. (Univ., Padua); Pasti, P. pp 604-606 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

A class of singularities in the Lorentz plane are considered which in general do not lead to factorized contributions to inclusive cross sections. Their consistency in inclusive sum rules is considered paying particular attention to azimuthal correlations. Finally, phenomenological consequences are discussed in the light of the new data on elastic and total pp cross sections. (auth)

8416 PARTICLE PRODUCTION IN COMPLEX NUCLEI. Van Hove, L. (CERN, Geneva). pp 619-624 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868-.

Two experiments are discussed which suggest that the study of high energy hadron collisions on complex nuclei may well become an important source of information on multiparticle hadrodynamics. For the first experiment on diffraction dissociation of a 15-GeV/c pion into 3 and 5 pions on nuclei which remain in their ground state it is found that the total cluster-nucleon cross section is about equal to the pion-nucleon cross section, namely 25 mb, with little dependence on the cluster mass throughout the A bump. The second experiment is based on an emulsion exposure in the 200-GeV proton beam. One looks at general production processes on nuclei, especially the heavier nuclei of the emulsion. The main result is the low multiplicity of the charged secondaries. (JFP)

8417 YAMAGUCHI-TYPE FORM FACTORS FOR NUCLEON-NUCLEON INTERACTIONS. Crepinsek, L.; Oberhummer, H.; Plessas, W.; Zingl, H. (Univ., Graz). Acta Phys. Austriaca; 39: No. 4, 345-354(1974).

A short review about some separable potentials for nucleon-nucleon interactions is presented. (auth)

8418 SEPARABLE APPROXIMATIONS OF LOCAL POTENTIALS AND THE THREE-BODY PROBLEM. Fournier, A.; van Haeringen, H.; Kok, L. P.; Smits, J. W. (State Univ., Groningen, Netherlands). Acta Phys. Austriaca; 39: No. 4, 393-415(1974).

The application of the Weinberg, unitary pole, Kowalski-Noyes, and quasi-Born approximations are considered for various local potentials in the three-body problem for the bound state and scattering region below breakup threshold. Convergence properties of the separable expansions are discussed. On the basis of the results it is hard to single out one of the approximations as being the best, however, the unitary pole expansion seems easiest to handle. Mainly for this reason it is to be preferred. (auth)

Particle Invariance Principles and Symmetries

General

Refer also to abstract 8615.

8419 DETERMINATION OF THE RELATIVISTIC WAVE EQUATIONS ASSOCIATED WITH A GIVEN REPRESENTATION OF SL(2,C). Hurley, W. J.; Sudarshan, E. C. G. (Univ. of Texas, Austin). J. Math Phys. (N. Y.); 16: No. 10, 2093-2098(Oct 1975).

Straightforward algebraic techniques are presented and used to determine the structure of wave equations whose relativistic covariance is governed by two representations of SL(2,C), S_0(LAMBDA) equals (1,1/2) + (1/2,1) + (1/2,0) + (0,1/2) and S_1(LAMBDA) equals S_0(LAMBDA) + (1/2,0) + (0,1/2), subject to the requirements that the equations should be parity preserving, admit an invariant Hermitian bilinear form realized by a numerical matrix eta, and that they should describe a particle with a unique mass and spin. It is shown that S_0(LAMBDA) leads to a unique algebraic structure, that of the Rarita–Schwinger equation, whereas S_1(LAMBDA) leads either to a trivial extension of the former case or to a family of equations whose matrices have a minimal algebra with degree one higher than that of the former case. One such example reproduces the equation presented by Glass. When, contrary to custom, a singular eta matrix is considered, it is shown that S_1(LAMBDA) allows for equations whose coefficient matrices are reducible but indecomposable. These equations are completely equivalent to the Rarita–Schwinger equation in the free case, but the added components may enter the dynamics in the presence of certain interactions. The present examples serve to illustrate techniques which may be applied in the study of any relativistic wave equation. (auth)

8420 CONTINUOUS SUBGROUPS OF THE FUNDAMENTAL GROUPS OF PHYSICS. I. General Method and the Poincare Group. Patera, J. (Univ., Montreal); Winternitz, P.; Zassenhaus, H. J. Math. Phys. (N. Y.); 16: No. 8, 1597-1614(Aug 1975).

A general method is presented for reducing the problem of finding all continuous subgroups of a given Lie group, G, with a nontrivial invariant subgroup, N, to that of classifying the subgroups of N and the subgroups of the factor group G/N. The method is applied to classify all continuous subgroups of the Poincare group (PG) and of the Lorentz group extended by dilatations [the homogeneous similitude group (HSG)]. Lists of representatives of each conjugacy class of subalgebras of the Lie algebras of the groups PG and HSG are given in the form of tables. (5 tables) (auth)

8421 CONTINUOUS SUBGROUPS OF THE FUNDAMENTAL GROUPS OF PHYSICS. II. The Similitude Group. Patera, J. (Univ., Montreal); Winternitz, P.; Zassenhaus, H. J. Math. Phys. (N. Y.); 16: No. 8, 1615-1624(Aug 1975).

All subalgebras of the similitude algebra (the algebra of the Poincare group extended by dilatations) are classified into conjugacy classes under transformations of the similitude group. Use is made of the classification of all subalgebras of the Poincare algebra, carried out in a previous article. The results are presented in tables listing representatives of each class and their basic properties. (5 tables) (auth)

Applications (Electromagnetic and Weak)

8422 COLLIDING BEAM TEST OF NEUTRAL ISOSCALAR AXIAL CURRENT. Mani, H. S. (Indian Inst. of Tech., Kanpur); Roy, P. Pramana; 4: No. 6, 264-270(Jun 1975).

The condition for the presence of isoscalar parity violating neutral currents is discussed, and it is noticed that it is ¬resent in most gauge-theoretic models of weak interactions. The possibility of testing its presence in e^+e^- colliding beams is investigated thoroughly, and it is found that parity violation in the reaction $e^+e^- \rightarrow \Lambda^\circ \Lambda^\circ$ would provide an unambiguous test for such a current. (auth)

Applications (Strong)

8423 (LA-UR-75-2050) PARITY VIOLATING ASYMMETRY IN THE RADIATIVE CAPTURE OF POLARIZED NEUTRONS BY PROTONS. Craver, B. A.; Kim, Y. E.; Tubis, A.; Herczeg, P.; Singer, P. (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-eng-36. 4p. (CONF-760101-1). Dep. NTIS $4.50.

From international conference on few body problems in nuclear and particle physics; Delhi, India (29 Dec 1975).

A parity violating effect of interest in the n + p yields d + gamma reaction is the asymmetry alpha in the photon angular distribution with respect to an initial neutron polarization. Calculations of alpha, using a two-nucleon Reid soft core potential, are reported. The calculations, exact with respect to the strong interaction, are facilitated by Green's function techniques. (6 figures, 2 tables) (SDF)

Scattering Theory

8424 ECLECTIC VIEW OF THE POMERON. DeTar, C. (Massachusetts Inst. of Tech., Cambridge). pp 344-354 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

A discussion is presented on the question of the nature of the complex angular momentum singularity that governs the high energy behavior of elastic amplitudes, namely, the pomeron. (JFP)

8425 DUALITY IN REGGEON–PARTICLE SCATTERING. Hoyer, P. (Research Inst. for Theoretical Physics, Helsinki). pp 517-528 of Proceedings of the IV International Symposium on Multiparticle Hadrodynamics. Duminio, F. (ed.). Pavia, Italy; Istituto Nazionale di Fisica Nucleare (1973).

From 4th international symposium on multiparticle hadrodynamics; Pavia, Italy (31 Aug 1973). See CONF-730868–.

Some recent progress in understanding the duality properties of Reggeon-particle amplitudes is reviewed. Finite energy sum rules may be derived not only for the Reggeon-particle total cross section (FMSR), but also for the two-body final state. Applications of both of these sum rules to resonance production data are presented. (auth)

8426 SUPERPOSITION PRINCIPLE FOR SIEGERT RESONANT STATES. Heutis, D. L. (California Inst. of Tech., Pasadena). J. Math. Phys. (N. Y.); 16: No. 10, 2148-2152(Oct 1975).

The utilization of the Siegert resonant states as a natural basis for the scattering process has been constrained by the lack of a convergent superposition formula. This paper presents such an expansion of the exact scattering wave function over the s-wave Siegert resonant states for finite-range potentials. Any integral property of the scattering wave function can then be calculated from the resonances. (3 figures, 1 table) (auth)

8427 DENSITY OF THE BREIT-WIGNER FUNCTIONS. Perry, W. L.; Luning, C. D. (Texas A and M Univ., College Station). J. Math. Phys. (N. Y.); 16: No. 8, 1569-1572(Aug 1975).

It is shown, for certain sequences [lambda/sub 1/] in the complex plane, that linear combinations of the Breit-Wigner functions [B/sub 1/] approximate, in the mean square, any function in L^2 (0,infinity). Implications and numerical use of this result are discussed. (auth)

8428 SOLUTION OF THE THREE-BODY PROBLEM AT ZERO ENERGY BY THE BOUNDARY CONDITION METHOD. Beloozerov, N. N. Teor. Mat. Fiz.; 23: No. 1, 78-93(Apr 1975). (In Russian).

A system of three identical spinless bosons interacting by means of two-particle potentials of the finite range is considered. The Schroedinger equation is reduced to the problem with boundary conditions, with the aid of the assumption that the logarithmic derivative of the wave function on the potential surface does not depend on the third particle position outside the six-dimensional sphere with the radius R in configuration space. In this region the ratio r_0/R is a small parameter. In the lowest approximation with respect to this parameter the sequence of the boundary problem solutions at zero total energy is found. It is shown that for constructing the wave function, the generalized Fourier method can be applied, the elementary solutions of which coincide with the functions obtained. (auth)

8429 EQUATION IN CLOSED FORM FOR THE ONE-PARTICLE GREEN FUNCTION IN EIKONAL APPROXIMATION. Bogdanov, A. V.; Dubrovskii, G. V. (Leningrad State Univ.). Teor. Mat. Fiz.; 23: No. 1, 94-103(Apr 1975). (In Russian)

A perturbation theory series for statistical T-matrix describing the pair correlations in the system of strongly interacting particles is summed up in the eikonal approximation to give the statistical analog of the Glauber scattering amplitude. The corresponding collision integral has a cross section depending upon media and statistics and valid for the theory of moderately dense gases and quantum liquids and can be generalized for taking into account the triple correlations. (auth)

8430 N-BODY SCATTERING. I. The Algebraic Structure of Transition Amplitude and Integral Equations. Pao, C. K. (Inst. of High Energy Physics, Peking). Wu Li Hsueh Pao; 24: No. 3, 215-223(May 1975). (In Chinese)

A useful auxiliary mathematical tool is introduced whereby various types of integral equations of coupling for adjacent nuclei were formulated. (auth)

PHYSICS (LOW-TEMPERATURE)

Superconductivity

Refer also to abstracts 7750, 7752, 7790, 7825, 7836, 7837, and 7859.

8431 (COO-1569-132) EXPERIMENTAL STUDIES IN SOLID STATE AND LOW TEMPERATURE PHYSICS. Progress Report, 1975. Goldman, A. M.; Weyhmann, W. V.; Zimmermann, W. Jr. (Minnesota Univ., Minneapolis (USA). School of Physics). Sep 1975. Contract E(11-1)-1569. 27p. Dep. NTIS $5.00.

Experimental investigations are being carried out in a broad area of low-temperature and solid-state physics which includes superconductivity, magnetism in metals and liquid and solid helium. The pair-field susceptibility of superconductors is being studied. A propagating mode in the phase of the superconducting order parameter has been found. Heat capacities of superconducting films in the vicinity of T/sub c/ are also being investigated. An investigation in the time-dependent high conductivity of dilute solid solutions of sodium in ammonia has been initiated. Nuclear orientation studies of the dilute magnetic impurity problem in metals in the 1 mK temperature region are being carried out. Refrigeration requirements for this work are being met using enhanced hyperfine nuclear cooling. Measurements of the differential osmotic pressure of $^3He/^4He$ liquid mixtures near the tricritical point have shown a peak in the "concentration susceptibility" at the lambda line. Data obey a simple tricritical scaling relation. The dynamics of superfluid flow through submicron pores are being studied in both pure ^4He and in $^3He/^4He$ mixtures in an apparatus provided with a ^3He refrigerator. The quantization of circulation in superfluid liquid ^4He is being investigated using the Vinen method. The low temperature heat capacity of bcc solid ^3He is being studied. (auth)

8432 (COO-2314-7) TEMPERATURE DEPENDENCE OF CONTACT POTENTIAL IN SUPERCONDUCTING NIOBIUM. Pipes, P. B.; Darling, D. H. (Dartmouth Coll., Hanover, N. H. (USA). Dept. of Physics and Astronomy). 1975. 4p. (CONF-750827-3). Dep. NTIS $4.50.

From 14th international conference on low temperature physics; Otaniemi, Finland (14 Aug 1975).

For a superconductor in a stationary condition, it can be shown that a gradient in the chemical potential is balanced by a gradient in the internal electrostatic potential. An attempt has been made to measure these electrostatic effects directly for niobium by measuring the temperature derivative of the contact potential as a function of temperature. (1 figure) (SDF)

8433 HIGH CRITICAL TEMPERATURE OF SUPERCONDUCTING COMPOUNDS WITH β-TUNGSTEN STRUCTURE. Yin, T. L. (Peking Univ.). Wu-li; 4: No. 1, 31-37(Feb 1975). (In Chinese)

The problem of finding high T_c alloys and compounds is discussed. The theories of Labbe, Frohlich, Matthias and others are reviewed. The directions for experimental research are discussed. β-W structure compounds show promise for practical use. (JPRS)

8434 NOISE VOLTAGES PRODUCED BY FLUX MOTION IN SUPERCONDUCTORS. Jarvis, P.; Park, J. G. (Imperial Coll. of Science and Tech., London). J. Phys., F (London); 5: No. 8, 1573-1592(Aug 1975).

The transport of magnetic flux in type 1 and type 2 superconductors under the influence of a transport current gives rise to a noise voltage with power spectrum W_f superposed on the DC voltage $\langle V \rangle$. Measurements of W_f are reported for cold-rolled strips and discs of type 1 and type 2 InPb alloys. For the type 2 strips a new phenomenon is observed; peaks in W_f which are very sensitive to current density and magnetic field. The general features of the W_f measurements are compared, where possible, with various models of flux motion. For the type 1 strips with leads of different separation a similar dependence of W_f on frequency f is found; a result which cannot be interpreted according to any of the simple random pulse models. A comparison of the results for strips and discs suggests that for the type 2 samples the noise is largely determined by the influence of sample edges and that there are two regimes in each of which different models of flux motion are more likely to be successful in interpreting noise measurements: a low voltage regime (when $\langle V \rangle$ is small) in which flux transport takes place by the motion of lattice defects, and a high voltage regime (large $\langle V \rangle$) in which the motion can be better described in terms of moving chains of irregularly spaced vortices. (auth)

8435 THERMAL CONDUCTIVITY OF TWO-ZONE SUPERCONDUCTORS. Vladimir, M. I.; Moskalenko, V. A. (Inst. of Applied Physics, Moldovian, USSR). Teor. Mat. Fiz.; 23: No. 1, 104-110(Apr 1975). (In Russian)

Thermal conductivity coefficient of two-zone superconductors with the paramagnetic and non-magnetic admixtures is considered at different concentrations of the latter. The density of electron states $n(\nu)$ of the one-zone superconductor with the paramagnetic admixture is also considered, which is necessary for calculating the thermal conductivity coefficient. General expression for the function $n(\nu)$ in the whole interval of frequencies is obtained, which is not connected with any restrictions on the admixture concentration. (auth)

8436 KINETIC EQUATIONS FOR RELAXATION PROCESSES IN SUPERCONDUCTING ALLOYS. Galaiko, V. P. (Physical-Technical Inst. of Low Temperatures, Kharkov). Teor. Mat. Fiz.; 23: No. 1, 111-120(Apr 1975). (In Russian)

The study of time evolution of the generalized electron-hole density matrix of the superconductor is continued taking into account the scattering of electrons on admixtures in dirty superconducting alloys. In this case the free run length of the electrons is small as compared with the macroscopic coherence radius of the superconducting electrons. However, according to the Anderson theorem, scattering on nonmagnetic admixtures does not destroy the superconducting correlations. With the aid of the special asymptotic expansions the simplified kinetic equations are constructed, which describe the dynamics of these correlations (as well as the dynamics of the electron excitations) after the relaxation of electrons on admixtures. (auth)

8437 SUBHARMONIC GAP STRUCTURE AND SUBHARMONIC JOSEPHSON STEPS. Hasselberg, L. E. (Technical Univ. of Denmark, Lyngby); Levinsen, M. T.; Samuelsen, M. R. J. Low Temp. Phys.; 21: No. 5/6, 567-587(Dec 1975).

Subharmonic microwave-induced Josephson step structure is often observed in superconducting junctions that exhibit subharmonic gap structure. The two theories, multiparticle tunneling and self-coupling due to an electromagnetic field set up by the ac Josephson current, which have been suggested to explain the subharmonic gap structure are investigated with respect to the possible existence of subharmonic Josephson steps. Also treated is a Ginzburg-Landau calculation of the current–phase relation for Josephson junctions. All three theories give subharmonic Josephson steps with the same microwave-power dependence. The temperature dependence of the subharmonic step structure and the subharmonic gap structure is discussed. It seems the self-coupling is the main cause for both effects in tunnel junctions and for the subharmonic gap structure in Dayem bridges, while the subharmonic step structure in the Dayem bridge seems to be a geometrical effect related to "multiparticle" transfer processes. (3 figures) (auth)

8438 COLLECTIVE MODES IN CHARGED, GAPLESS SUPERCONDUCTORS. Bray, A. J. (Univ. of Maryland, College Park); Schmidt, H. J. Low Temp. Phys.; 21: No. 5/6, 669-686 (Dec 1975).

The collective modes of charged, gapless superconductors are discussed within the framework of the Gor'kov–Eliashberg theory, and the dynamical pair-field susceptibility is calculated. The effect of the charge is to replace the characteristic oscillations (fourth sound) associated with the uncharged system by a diffusive behavior qualitatively similar to that predicted by time-dependent Ginzburg–Landau theory. For sufficiently small pair breaking, rho less than or equal to 10^{-3}, and sufficiently close to T/sub c/, (T/sub c/ - T)/T/sub c/ less than or equal to 4×10^{-6}, a new oscillating mode appears, with omega proportional to (T/sub c/ - T)/sup 1/3/q/sup 4/3/, in both charged and uncharged systems. (5 figures) (auth)

PHYSICS (NUCLEAR)

8439 (CONF-750303-77) RADIOACTIVE-NUCLIDE DECAY DATA IN SCIENCE AND TECHNOLOGY. Reich, C. W.; Helmer, R. G. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA). Idaho National Engineering Lab.). 1975. 7p. Dep. NTIS $4.50.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

The scope of ENDF/B has recently been expanded to include radioactive-nuclide decay data. In this paper, the content and organization of the decay data which are included in ENDF/B are presented and discussed. The application of decay data in a wide variety of nuclear-related activities is illustrated by a number of examples. Two items pointed up by the ENDF/B decay-data compilation effort are treated: the identification of deficiencies in the data; and the importance of a radioactive-nuclide metrology effort oriented toward supplying these needs in a systematic fashion. (3 figures, 1 table) (auth)

8440 (ZFK-243) JOINT ANNUAL REPORT, 1972. Netzband, D. (ed.). (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Sep 1972. 212p. (In German). Dep. NTIS (US Sales Only) $13.75.

Brief reports are presented on the wide range of activities of the institute. Work on nuclear reactions is summarized first. Then nuclear spectroscopy and theoretical results are treated. Preparatory and analytical work and work on the mass separator has begun. The status of the accelerators is then reviewed, including that of a new Soviet tandem, EGP-10-1. Work on experimental measuring methods and electronics for nuclear physics is then recounted. New computer programs are briefly described, and a synopsis of publications, theses, etc., is given. Items with significant amounts of information are listed separately by title. (RWR)

For titles of individual papers see: 8452, 8463–8465, 8473, 8474, 8488–8490, 8497–8504, 8516–8537, and 8555–8557.

Neutron Interactions with Matter

8441 (KFK-2046, pp 63-72) NEUTRON CAPTURE IN REACTOR STRUCTURAL MATERIALS. Macklin, R. L. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

1 fig.; 14 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

A report is given on the activities on the measurement of capture cross sections in structure materials which are, at present, being carried out at various universities and research centers in the USA. (GE)

8442 (KFK-2046, pp 73-78) SOME PROBLEM AREAS IN CAPTURE CROSS-SECTION MEASUREMENTS. Moxon, M. C.; Gayther, D. B.; Sowerby, M. G. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

1 fig.

In neutron capture in the KeV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

This paper outlines some of the problems that have been encountered and are envisaged in the measurement and evaluation of capture cross-sections. Particular emphasis is placed on the cross-sections of the structural materials used in fast reactors. The topics considered are the influence of scattered neutrons, the determination of background, sample thickness corrections, and the theoretical representation of resonance parameters. (GE)

8443 (KFK-2046, pp 79-92) CAPTURE CROSS SECTION MEASUREMENTS ON REACTOR STRUCTURAL MATERIALS WITH A LARGE LIQUID SCINTILLATOR DETECTOR. Spencer, R. R.; Beer, H. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

With figs.; 4 tabs.; 4 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

A brief, general outline is given of the use of the large liquid scintillator for measurement of the capture cross sections of medium weight nuclei in the resolved resonance region. The method of data reduction and some examples of the results on ^{50}Cr and ^{54}Fe are shown. (GE)

8444 (KFK-2046, pp 93-97) SUMMARY ON TOPIC I: EXPERIMENTAL DATA. Froehner, F. H. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

9 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik Und Reaktortechnik).

This paper summarizes the results of papers presented at the NEACRP/NEANDC specialist meeting, held in May 73 at the Kernforschungszentrum Karlsruhe, dealing with experimental data for neutron capture cross sections in structural materials. (GE)

8445 (KFK-2046, pp 99-155) COMPARISON BETWEEN SINGLE LEVEL AND MULTILEVEL CALCULATIONS OF NEUTRON CROSS SECTIONS IN THE RESONANCE REGION. Martinelli, T.; Menapace, E.; Motta, M.; Panini, G. C. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

34 figs.; 10 tabs.; 8 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

The aim of the present paper is a comparison of cross sections and deduced group averaged values resulting from the application of single level and multilevel formulas to the same multilevel resonance parameters. The parameters were partly taken from Karlsruhe Center's publications and communications and partly from ENDF/B-III. They refer to isotopes or elements of great importance, owing to their utilizations as structural material in reactor construction. (auth)

8446 (KFK-2046, pp 251-256) SUMMARY ON TOPIC II: EVALUATED DATA. Ribon, P. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

The paper summarizes the results of papers dealing with evaluation methods for capture cross section presented at the NEACRP/NEANDC specialist meeting held in May 73 at the Kernforschungszentrum Karlsruhe. (GE)

8447 (KFK-2046, pp 317-342) COMPARISON OF EFFECTIVE CAPTURE CROSS SECTIONS AND DOPPLER COEFFICIENTS FOR STRUCTURAL MATERIALS CALCULATED BY THREE EVALUATED NUCLEAR DATA FILES. Takano, H.; Ishiguro, Y. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

9 figs.; 9 tabs.; 7 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

From the viewpoint of the Doppler effect calculation of structural materials, a study is made to grasp the present situation of the nuclear data in the keV energy region. The resonance shielding factors for the effective capture cross sections of Cr, Fe, and Ni are calculated by using the resonance parameters sets from the evaluated files, ENDF/B-II and -III, and Story's evaluation data. Using these shielding factors, the Doppler coefficients for stainless steel and natural iron are calculated by one dimensional simple perturbation method and are compared with the experimental values measured in the JAERI-FCA assembly V-1 and -2 cores. The differences among the Doppler coefficients obtained from three evaluated data are very large and are mainly caused by the uncertainties in the 1.15 keV resonance parameter of ^{56}Fe and in the smooth capture cross section near the resonance energy. (auth)

8448 (KFK-2046, pp 343-348) SENSITIVITY CALCULATIONS IN AN IRON SHIELD WITH CAPTURE CROSS SECTIONS CHANGED IN THE keV RANGE. Penkuhn, H. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

3 tabs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

The problem of whether a better knowledge of the absorption cross sections for the intermediate neutrons is of importance in a steel shield is discussed. Calculations done with the transport code CINNA show that even in a very thick iron shield these capture cross sections do not critically change the neutron transmission. (auth)

8449 (LA-6145-MS) COARSE-MESH REBALANCE METHODS COMPATIBLE WITH THE SPHERICAL HARMONIC FICTITIOUS SOURCE IN NEUTRON TRANSPORT CALCULATIONS. Miller, W. F. Jr. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-Eng-36. 16p. Dep. NTIS $4.00.

The coarse-mesh rebalance method, based on neutron conservation, is used in discrete ordinates neutron transport codes to accelerate convergence of the within-group scattering source. Though very powerful for this application, the method is ineffective in accelerating the iteration on the discrete-ordinates-to-spherical-harmonics fictitious sources used for ray-effect elimination. This is largely because this source makes a minimum contribution to the neutron balance equation. The traditional rebalance approach is derived in a variational framework and compared with new rebalance approaches tailored to be compatible with the fictitious source. The new approaches are compared numerically to determine their relative advantages. It is concluded that there is little incentive to use the new methods. (3 tables, 5 figures) (auth)

8450 (ORNL-TM-4660) 16 AND 123 GROUP WEIGHTING FUNCTIONS FOR KENO. Knight, J. R.; Petrie, L. M. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-Eng-26. 78p. Dep. NTIS $5.45.

Weighting functions for use in the KENO Monte Carlo criticality program have been prepared. Discrete ordinate neutron transport calculations provided adjoint fluxes in reflector materials commonly encountered in KENO calculations. 16 and 123 group weights for water, paraffin, concrete, and graphite were computed by the adjoint biasing method. The results of these calculations are presented in the form of tables and graphs. The use of these weights in various applications has significantly reduced the number of neutron histories required to obtain a given variance in the k/sub eff/ computed by KENO. (8 tables, 9 figures) (auth)

8451 (ORNL-TM-5072) MEASUREMENT OF SECONDARY NEUTRONS AND GAMMA RAYS PRODUCED BY NEUTRON INTERACTIONS IN ALUMINUM OVER THE INCIDENT ENERGY RANGE 1 TO 20 MeV. Morgan, G. L. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-Eng-26. 34p. Dep. NTIS $4.00.

The spectra of secondary neutrons and gamma rays produced by neutron interaction in a thin sample (approximately 1/6 mean free path) of aluminum have been measured as a function of the incident neutron energy over the range 1 to 20 MeV. Data were taken at an angle of 125°. A linac (ORELA) was used as a neutron source with a 47-m flight path. Incident energy was determined by time-of-flight, while secondary spectra were determined by pulse-height unfolding techniques. The results of the measurements are presented in forms suitable for comparison to calculations based on the evaluated data files. (6 tables, 4 figures) (auth)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstract 8496.

8452 (ZFK-243, pp 33-34) MECHANISM OF THE ^{3}He(d,pt)p AND ^{3}He(d,p^{3}He)n REACTIONS AND THE N–N SCATTERING LENGTHS. Kuehn, B.; Moesner, J.; Schmidt, G.; Stiehler, T. Sep 1972. (In German).

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8453 CALCULATIONS OF THE $\frac{1}{2}^{-}$-RESONANCES OF THE MIRROR NUCLEI ^{7}Li AND ^{7}Be. Teufel, A. G. Tuebingen, Ger.; Tuebingen Univ. (1973). 110p. (In German). INIS.

Thesis.

Within the framework of the cluster model, a two-channel calculation is carried out using the so-called Robertson method which is consistently continued in the energy region below the threshold of the second channel. The $\frac{1}{2}^{-}$ resonances of ^{7}Li and ^{7}Be including their existing differences for these mirror nuclei are thus described. The Coulomb exchange terms must be exactly evaluated for this. Furthermore, certain characteristics of resonances are shown in the vicinity of thresholds and are illustrated by means of model calculations for ^{7}Li. Further resonance levels are discussed as examples. (GE)

8454 TOTAL THERMAL NEUTRON SCATTERING CROSS-SECTION OF HYDROGEN IN ZIRCONIUM HYDRIDE. Lu, T.; Yuan, C. H.; Li, J. C.; Sa, P. H.; Tung, S. F. Wu Li Hsueh Pao; 24: No. 3, 210-214(May 1975). (In Chinese)

A neutron crystal spectrometer was used to determine the total cross-section of hydrogen in zirconium hydride in the incident neutron energy range from 0.05 to 0.54 eV. By virtue of the simple harmonic and non-interference approximation and under the assumption that the phonon spectra are expressible by two 'quasi-Gaussian distributions, the differential thermal neutron scattering cross-section of hydrogen in zirconium hydride was determined using the phonon expansion technique. This was followed by a Monte Carlo integration to determine the total scattering cross-section. The theoretically calculated values and the experimental results are in basic agreement to within the experimental error. (JPRS)

8455 (p,2p) REACTIONS ON LIGHT NUCLEI. Bhowmik, R. K. College Park, MD; Univ. of Maryland (1974). 184p. University Microfilms Order No. 75-17,879.

Thesis (Ph.D.).

The (p,2p) reactions on the target nuclei ^{6}Li, ^{7}Li and ^{12}C have been studied at 100 MeV bombarding energy using the University of Maryland Sectored Isochronous Cyclotron. The energies of both the outgoing protons have been measured in coincidence in a coplanar symmetric geometry to obtain the energy and angular correlation between the detected protons. Care has been taken to obtain good energy and momentum resolution in order to separate the different excited states of the residual nuclei. The experimental data are presented in a form suitable for direct comparison with theory. In the case of ^{6}Li(p,2p)^{5}He reaction leading to the "ground state" region of the residual nucleus, a cluster model description of ^{5}Li and a scattering state approximation of the residual nucleus can explain most of the features of the experimental data. In the case of ^{7}Li and ^{12}C, the DWIA model can qualitatively explain the change in shape of the momentum distributions for the ground states of the residual nuclei extracted from the energy sharing spectra at different angle pairs. The detailed quantitative agreement with DWIA is however somewhat poor indicating the necessity of a more exact treatment of three body effects. The knockout of the 1s proton is observed for all three nuclei studied. The cross section becomes progressively weaker in going from ^{6}Li to ^{12}C. (auth)

Nuclear Properties and Reactions, 6 ≤ A ≤ 19

Refer also to abstracts 8455, 8487, 8496, and 8555.

8456 (COO-3244-48) STUDIES OF LOW ENERGY PI ELASTIC SCATTERING FROM LIGHT NUCLEI. Eisenstein, R. A. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)). 1975. 18p. (CONF-7506100-1). Dep. NTIS $4.50.

From proceedings of the advanced study institute in nuclear and particle physics at intermediate energies; Victoria, B. C., Canada (Jun 1975).

The elastic scattering of π^{+} from ^{12}C has been investigated at 50 MeV. The angular distribution is compared with theoretical predictions using free pi-N phase shifts in three potentials: the Kisslinger potential, the local Laplacian potential, and a separable potential. It is concluded that simple K and LL models are inadequate for a description of pi elastic scattering at low energy. (2 tables, 7 figures) (SDF)

8457 (DESY-SR-75/08) OBSERVATION OF THE REAL Li K ABSORPTION EDGE. Petersen, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Jul 1975. 4p. INIS.

2 figs.; 22 refs.

The Li K absorption edge was measured with yield spectroscopy at liquid nitrogen temperature. The broad feature hitherto considered to be the edge is shown to be a combination of a sharp absorption edge corresponding to a 0.18 eV wide Li K core level and a rising density of states at the Fermi level. (auth)

8458 (N-74-33160) RESEARCH PROGRAM IN NUCLEAR AND SOLID STATE PHYSICS. Annual Report, 1 September 1973–3 August 1974. (Virginia State Coll., Petersburg (USA)). 30 Sep 1974. 47p. (NASA-CR-140054). NTIS $5.50.

The survey of negative pion absorption reactions on light and medium nuclei was continued. Muon spin precession was studied using an iron target. An impulse approximation model of the pion

absorption process implied that the ion will absorb almost exclusively on nucleon pairs, single nucleon absorption being suppressed by energy and momentum conservation requirements. For measurements on both paramagnetic and ferromagnetic iron, the external magnetic field was supplied by a large C-type electromagnet carrying a current of about 100 amperes. (STAR)

8459 (RLO-1388-290) OBSERVATION OF RESONANCES IN ^{24}Mg AT 32-40 MeV EXCITATION ENERGY VIA THE ^{12}C(^{12}C, ^{8}Be)^{16}O REACTION. Eberhard, K. A.; Mathiak, E.; Stettmeier, J.; Trombik, W.; Weidinger, A.; Wuestefeld, L. N.; Bernhardt, K. G. (Muenchen Univ. (F. R. Germany). Sektion Physik; Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1975. 10p. Dep. NTIS $4.50.

Strongly correlated resonances are observed in ^{12}C(^{12}C,^{8}Be)^{16}O excitation functions at E/sub x/ equals 32.6 and 39.6 MeV to various excited states in ^{16}O. At these energies correlated structures are also present in ^{12}C(^{12}C,alpha)^{20}Ne and ^{10}B(^{14}N,alpha)^{20}Ne excitation functions as reported by other workers in recent months. (auth)

8460 (RLO-1388-291) ONE-NEUTRON AND TWO-NEUTRON TRANSFER IN THE SCATTERING. Reisdorf, W. N.; Lau, P. H.; Vandenbosch, R. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1975. 45p. Dep. NTIS $5.00.

Angular distributions have been measured for one- and two-neutron transfer reactions induced by ^{18}O beams on ^{16}O targets at laboratory bombarding energies of 42 and 52 MeV. The reactions populating the ground and first excited states of ^{17}O and ^{18}O are analyzed in terms of single step finite range plus recoil DWBA theory taking into account antisymmetrization effects. Special attention is paid to an internally consistent description of the observed absolute magnitudes of all the reactions and to the theoretically expected interferences between various backward-forward scattering mechanisms. The importance of neutron transfer in accounting for different absorbing properties of the ^{16}O-^{16}O systems as compared to the ^{16}O-^{16}O system is shown. (13 figures, 2 tables) (auth)

8461 (RLO-1388-293) SPIN ASSIGNMENT OF J/sup pi/ equals 12^{+} FOR THE ^{12}C + ^{12}C RESONANCE AT E/sub 12C/(c.m.) equals 18.5 MeV. Bernhardt, K. G.; Eberhard, K. A.; Weidinger, A. (Washington Univ., Seattle (USA). Nuclear Physics Lab.; Muenchen Univ. (F. R. Germany). Sektion Physik). 1975. 2p. Dep. NTIS $4.50.

In an effort to obtain a more precise picture of the recently observed resonances in ^{12}C(^{12}C,alpha)^{20}Ne, ^{10}B(^{14}N,alpha)^{20}Ne, and ^{12}C(^{12}C,^{8}Be)^{16}O excitation functions between energies of 30 to 40 MeV in the corresponding compound nucleus ^{24}Mg, angular distributions in this energy range for the ^{12}C(^{12}C,^{8}Be)^{16}O reaction have been measured. The particle unstable ^{8}Be nucleus was identified through the coincident detection of the two alpha-particles by which it decays. The most prominent resonance observed in the ^{12}C(^{12}C,alpha)^{20}Ne and ^{12}C(^{12}C,^{8}Be)^{16}O excitation functions occurs at E/sub ^{12}C/(c.m.) equals 18.5 MeV. Angular distributions measured on and off resonance are reported, and a unique spin assignment of J/sup pi/ equals 12^{+} for this resonance is made. (auth)

8462 (RLO-1388-295) MIRROR GAMMA DECAYS IN ^{13}C AND ^{13}N. Marrs, R. E.; Adelberger, E. G.; Snover, K. A.; Cooper, M. D. (Washington Univ., Seattle (USA). Dept. of Physics). 1975. 13p. Dep. NTIS $4.50.

The gamma-ray branching ratios of the lowest T equals $^{1}/_{2}$ levels in ^{13}C and ^{13}N, and the absolute strength of the gamma$_0$ transition in ^{13}N have been measured. The mirror electromagnetic selection rule is obeyed by the M1 (gamma$_0$ and gamma$_2$) transitions. However the E1 (gamma$_1$) transitions exhibit a surprisingly large charge asymmetry. Charge dependent differences in the radial wave functions do not account for a similar asymmetry in strong T equals $^{1}/_{2}$ yields T equals $^{1}/_{2}$ E1 transitions in mass-13. (2 figures, 1 table) (auth)

8463 (ZFK-243, pp 35-38) REACTION ^{12}C(d,p)^{13}C NEAR 1.20 MeV. Lehmann, D.; Treffkorn, H. J.; Dolak, W. (Karl-Marx-Univ., Leipzig). Sep 1972. (In German).

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8464 (ZFK-243, pp 113-114) RESONANCE STRUCTURE OF THE REACTION ^{16}O(γ,n)^{15}O IN THE CONTINUUM SHELL MODEL IN PARTICLE-HOLE APPROXIMATION. Barz, H. W. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Rotter, I.; Hoehn, J. Sep 1972. (In German).

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8465 (ZFK-243, pp 114-115) CALCULATION OF ANGULAR DISTRIBUTION AND POLARIZATION FOR RESONANCE REACTIONS IN THE COUPLED-CHANNELS FORMALISM. Seidel, C.; Barz, H. W. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8466 INVESTIGATION ON THE REORIENTATION OF NUCLEI IN SOLIDS BY MEANS OF β- AND γ-DECAY ANISOTROPIES AFTER CAPTURE OF POLARIZED NEUTRONS. Dubbers, D. Heidelberg; Heidelberg Univ. (1973). 73p. (In German). INIS.

Thesis.

The change of the orientation state of polarized ^{20}F(11.0 sec) nuclei in MgF_2 and CaF_2 monocrystals was investigated under the effect of internal and external fields. The dipolar initial polarization of the nuclei was produced by the capture of polarized thermal neutrons in ^{19}F and detected by the left-right asymmetry of the subsequent β-decay. The reorientation of the ^{20}F ground state in the surrounding fields is shown by the dependence of the β-decay asymmetry on the relative field parameters and by the occurrence of an anisotropy of the γ-transitions in ^{20}Ne following the β-decay. Four different reorientation mechanisms were investigated. (GE)

8467 SCATTERING OF 14.2 MeV POLARIZED NEUTRONS BY ^{2}H AND ^{12}C. Casparis, R.; Leemann, B.; Preiswerk, M.; Rudin, H.; Wagner, R.; Zupranski, P. (Univ., Basel). Helv. Phys. Acta; 48: 45-47(1975).

Using polarized 14.2-MeV neutrons, the angular distribution of the analyzing power for the ^{12}C(n,n') inelastic scattering and the neutron polarization for the elastic scattering were measured. (JFP)

8468 INTERMEDIATE ENERGY PION SCATTERING FROM LIGHT CLOSED SHELL NUCLEI. Piepho, M. G. Bloomington, IN; Indiana Univ. (1975). 96p. University Microfilms Order No. 75-17,064.

Thesis (Ph. D.).

An intermediate energy pion-nucleus optical potential is derived in detail from a multiple scattering formalism based on the work of Foldy-Walecka. Assuming a separable microscopic potential, Foldy and Walecka have considered the scattering of a projectile from a many-body system of fixed scatterers (i.e., the nucleon mass is considered to be infinite). One of the basic approximations used is that the projectile energy is high enough so that closure may be used on the nuclear target. The Foldy-Walecka formalism is extended here to include spin and isospin degrees of freedom, a complex separable potential parametrization of the pion-nucleus interaction, and the correct relativistic energy momentum for the pion. The main objective of this work is to apply this extended optical potential formalism to make predictions for pion elastic scattering from ^{12}C, ^{16}O, ^{28}Si, and ^{40}Ca. Total, inelastic, and elastic cross-section and angular distribution predictions for pion energy from 70 to 280 MeV are presented. Other contributions include transformation of the pion-nucleon center of mass scattering amplitudes to the laboratory scattering amplitudes where phase shifts were derived assuming a fixed scatterer, with an angle transformation analysis included. The pion-nucleon scattering data in the laboratory system is parametrized by a fixed scatterer separable potential which is obtained from an inverse scattering problem solution. This complex separable potential is used as microscopic input in the many-body pion nucleus elastic scattering problem. Also, semi-relativistic kinematics are presented in an inverse scattering parametrization of the pion-nucleon scattering data. Good agreement is obtained with the available experimental data on ^{12}C and ^{32}S. The zeroth-order optical potential derived here is capable of incorporating higher order corrections in a tractable manner and should, therefore, be a useful departure point for future investigations. (auth)

8469 (alpha,2 alpha) REACTION ON ^{16}O AND ^{28}Si AT E/sub alpha/ equals 850 MeV. Chirapatpimol, N. Los Angeles; Univ. of California (1975). 144p. University Microfilms Order No. 75-16,775.

Thesis (Ph. D.).

The quasi-free (alpha,2 alpha) reaction on ^{16}O and ^{28}Si was studied at E/sub alpha/ equals 850 MeV. The ^{16}O target was also studied at E/sub alpha/ equals 650 MeV. Data were taken in a coplanar geometry with angular settings of 31^{0}-57^{0} and 36^{0}-41^{0} for both targets at 850 MeV. Additional data were taken in a symmetric geometry with angular setting of 43.5^{0}-43.5^{0} for the ^{16}O target at 850 and 650 MeV. The two outgoing alpha particles were detected in coincidence by a magnetic spectrometer in one arm and by a large solid angle telescope in the other. A large ^{3}He background was observed in both arms. Special emphasis was made on measuring the time of flight and the energy of the recoil particle in the telescope arm, such that good accuracies were achieved in order to do the alpha-^{3}He separation. The result shows the direct separation of alpha particles from ^{3}He background in both arms. The knock-out and spallation processes were observed. The events from the latter were removed by imposing a strong

correlation between the energy and angle. The measured differential cross sections were obtained by integrating over the recoil solid angle and the dynamic range of measured energy in the magnetic spectrometer, as well as summing over the excitation energy of the residual nucleus. Predicted cross sections were calculated using the plane wave impulse approximation. The free alpha-alpha scattering cross section was used since the off-mass-shell effect can be neglected at this energy region. The wave function for the (alpha-cluster + residual core) system was calculated by assuming square well potential. The least chi-squared method with single parameter N/sub eff/, was employed to fit the calculated cross section with measured cross section. Good fits were obtained for both targets. (auth)

8470 RADIOACTIVE PRODUCTS FROM BORON CTR REACTIONS. Peterson, R. J. (Univ. of Colorado, Boulder); Zaidins, C. S.; Fritts, M. J.; Roughton, N. A.; Hansen, C. J. Ann. Nucl. Energy; 2: No. 6, 503-506(Jul 1975).

The nuclear reaction rates for $^{10}B(p,\alpha)^{7}Be$ and $^{10}B(p,\gamma)^{11}C$ have been measured by a thick target technique using proton energies from 75 keV to 3.0 MeV. The results are valid for proton temperatures near 3×10^9 K where the $^{11}B(p,3\alpha)$ reaction has been suggested for power generation. At this temperature, the rates $N_A(\sigma v)$ are 2.66×10^7 and 8.3×10^2 cm^3 g^{-1} s^{-1} for ^{7}Be and ^{11}C, respectively. As such, these rates suggest the possibility of serious radioactive contamination in using natural boron as a fuel in CTR devices. (auth)

8471 CHARACTERISTICS OF THE THIRD EXCITED STATE OF ^{6}Li. Schwartz, H.; Fou, C. M. (Univ. of Delaware, Newark). J. Phys., G (London); 1: No. 7, L57-L59(5 Sep 1975).

A kinematically complete study of the reaction $^{7}Li(^{3}He,\alpha)^{6}Li(d)$ was used to measure the excitation energy and width of the third excited state of ^{6}Li. The results $E_x = 4.3 \pm 0.1$ MeV and $\Gamma = 0.6 \pm 0.1$ MeV were obtained. (auth)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

Refer also to abstracts 7365, 8441, 8458, 8468, 8469, 8487, 8489, 8496, and 8508.

8472 (ORNL-TM-5081) GAMMA-RAY PRODUCTION DUE TO NEUTRON INTERACTIONS WITH SILVER FOR INCIDENT NEUTRON ENERGIES BETWEEN 0.3 AND 20 MeV: TABULATED DIFFERENTIAL CROSS SECTIONS. Dickens, J. K.; Love, T. A.; Morgan, G. L. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-Eng-26. 63p. Dep. NTIS $5.45.

Numerical values of differential cross sections for gamma rays produced by neutron reactions with silver have been obtained for neutron energies between 0.3 and 20 MeV for theta/sub gamma/ equals 125°. The d^{2}sigma/d omega dE values were obtained using a NaI spectrometer. These data are presented as gamma-ray production group cross-section values of d^{2}sigma/d omega dE for 0.3 less than or equal to E/sub gamma/ less than or equal to 10.5 MeV, with gamma-ray intervals ranging from 15 keV for E/sub gamma/ less than or equal to 0.4 MeV to 160 keV for E/sub gamma/ approximately 9 MeV. Neutron energy intervals varied from 0.10 MeV for E/sub n/ between 0.3 and 0.4 MeV to 3 MeV for E/sub n/ between 14 and 20 MeV. (auth)

8473 (ZFK-243, pp 30-31) STUDY OF THE TOTAL CROSS SECTION OF Si AND Cr IN THE NEUTRON ENERGY REGION AROUND 3 MeV. Ung, T.; Pose, H.; Seidel, K. (Technische Univ., Dresden). Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8474 (ZFK-243, pp 116-117) $^{28}Si(d,p)^{29}Si$ REACTION TO UNBOUND FINAL STATES. El-Naiem, A.; Barz, H. W. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8475 REACTIONS INDUCED ON ^{24}Mg BY MEDIUM ENERGY ALPHA-PARTICLE. Yang, G. C. C. Bloomington, IN; Indiana Univ. (1975). 231p. University Microfilms Order No. 75-17,073.

Thesis (Ph. D.).

Measurements, results, and analyses of the (alpha,alpha), and (alpha, ^{3}He) reactions on ^{24}Mg are described. Differential cross sections were measured over an angular range of 6°–103° in ½°–4° steps for elastic and inelastic scattering at 70 and 120 MeV alpha energies and for (alpha, ^{3}He) reaction at 70 MeV. The measured alpha-elastic scattering data along with those at 40, 50, 80, 104, and 166 MeV reported in the literature have been analysed in terms of the optical model, the folded nucleon-nucleus model and the folded alpha-nucleon model. The four-parameter nucleon-nucleus folding model is able to account for the data over a wide range of bombarding energies (20–166 MeV) and target masses (24–90 amu) as well as the six-parameter optical model and significantly better than the other folding model. Also, the energy and target mass dependences of the observed real central strength are consistent with the predictions based upon this folding model. In addition, the 120 MeV data were investigated in detail in terms of the optical model. With an overall energy resolution of 70–100 keV about 20 percent of the known states (about 200) in ^{24}Mg up to 16 MeV excitation were found to be preferably populated through the alpha-inelastic scattering. Analysis was performed in terms of the distorted-wave Born approximation theory. The DWBA calculations were able to reproduce the (alpha, ^{3}He) angular distributions for the well resolved states which involved low values of transferred angular momentum. The extracted spectroscopic factors for the low lying states of ^{25}Mg are found to be in good agreement with those from the (d,p) reaction studies and those from the theoretical Nilsson model embodying particle-rotation coupling and pairing effect. The 3.97 MeV and 7.31 MeV states are very strongly populated at the forward angles and their strengths account for a large fraction of the theoretical value for 1f/sub 7/2/ configuration. A theoretical understanding of the splitting of 1f/sub 7/2/ strength requires a mixing of the -ive parity model states of 1f/sub 7/2/, 1f/sub 5/2/, 2p/sub 3/2/, and 2p/sub 1/2/ configurations. (auth)

8476 MICROSCOPIC ANALYSIS OF THE (^{6}Li, ^{6}He) REACTION. Ciangaru, G. Stony Brook, NY; State Univ. of New York (1974). 174p. University Microfilms Order No. 75-16,227.

Thesis (Ph. D.)

The spin-isospin flip (^{6}Li,^{6}He) reaction was studied both experimentally and theoretically. The experiment was performed using 34 MeV $^{6}Li^{+++}$ beam from the FN tandem Van de Graaff incident upon ^{23}Na, ^{25}Mg, ^{26}Mg, ^{27}Al, ^{54}Fe and ^{58}Ni targets. The experimental data was obtained by using the standard DELTA E · E silicon detector techniques of mass separation. Optical model parameters were determined from elastic scattering on the Mg and Al targets. Annular distributions associated with the lowest $^{5}/_{2}+$, $^{1}/_{2}+$, $^{7}/_{2}+$ ^{25}Al, 5+, 3+, 1+ ^{26}Al, $^{5}/_{2}+$ ^{27}Si and 7+, 1+ ^{54}Co states were measured. The DWBA microscopic calculations were performed using Yukawa (mu equals 0.707 and 1.0 fm^{-1}) and $r^2 \cdot Y$ tensor (mu equals 1.0 fm^{-1}) potentials integrated over the projectile cluster model wave functions. Knock-on exchange effects for the central interaction were included in an approximate way following a technique developed earlier to study the inelastic and charge exchange interactions of projectiles with A less than or equal to 4. The nuclear states were described by $(1d_{5/2})^{-2}$ and $(1f_{7/2})^{-2}$ shell model configurations for the mass A equals 26 and 54 nuclei, respectively, one-particle Nilsson model configurations for the mass A equals 25 nuclei and both one-hole Nilsson model and sd-shell model configurations for the mass A equals 27 nuclei. The theoretical analysis of the data associated with ^{26}Mg showed reasonable agreement using the Yukawa potential with a range of 1.0 fm^{-1}. The result of including exchange effects was mainly to normalize the calculated cross sections, giving V_{11} strengths between 15.2 MeV and 18 MeV. The tensor potential with a strength V/sub T/ equals 2.2 MeV gave a negligible contribution to the calculated cross sections. The V_{11} strengths were in this case between 15.1 MeV and 16.4 MeV. The analysis of ^{54}Fe data showed a pronounced inhibition of the direct transitions due to the effect of the reaction Q-value. The shape of the experimental angular distributions for the ^{25}Mg and ^{27}Al target nuclei reflected the mixing of several orbital angular momentum components. The central potential alone could not explain the transitions to the ground states in ^{25}Al and ^{27}Si. To fit the shape and the magnitude of this data required considering a sum of central and tensor potentials with strengths V_{11} equals 13.1 MeV, V/sub T/ equals 3.2 MeV and V_{11} equals 11.5 MeV, V/sub T/ equals 2.3 MeV, respectively. (auth)

8477 DEFORMATION OF ^{24}Mg AS DETERMINED BY ELASTIC AND INELASTIC SCATTERING OF ^{12}C AND ^{16}O: AND SYSTEMATICS OF MEASURED DEFORMATIONS OF ^{24}Mg. Elliott, D. O. Jr. Austin, TX; Univ. of Texas (1975). 56p. University Microfilms Order No. 75-16,668.

Thesis (Ph. D.).

Elastic and inelastic scattering of ^{16}O and ^{12}C ions by ^{24}Mg is investigated and analyzed in terms of the optical model (for elastic scattering) and the coupled channels technique (for elastic and inelastic scattering). Deformation parameters for ^{24}Mg are extracted from the data. Further, these data are used, along with the results from previous experiments, in an examination of the effect of the projectile size on the measured deformation length, $beta_2R_0$. A trend in these data is observed which follows well the prediction by Hendrie, based on geometrical considerations. (auth)

8478 ELECTROMAGNETIC DECAY OF THE LOW-LYING EXCITED STATES IN ^{29}Al AND ^{61}Ni. Williams, J. R. Jr. Raleigh, NC; North Carolina State Univ. (1974). 172p. University Microfilms Order No. 75-17,091.

Thesis (Ph. D.).

A Compton linear polarimeter has been designed and constructed with five identical, 1.5 by 2.0 inch sodium iodide (NaI) crystals. The NaI polarimeter has been used in a study of the low-lying excited states in ^{29}Al using the ^{26}Mg(alpha,p gamma) ^{29}Al reaction with E/sub alpha/ equals 11.26 MeV. When considered together with the results of life-time and angular correlation studies from other works, these measurements confirm the $3/2^+$ spin-parity assignment for the level at 2.88 MeV. A definite J/sup pi/ equals $3/2^+$ assignment is made for the 2.23 MeV level, and a $1/2^+$ assignment is favored for the level at 1.76 MeV. These results, along with the experimental M1E2 transition strengths, are compared with the theoretical predictions of the shell model and the Nilsson model. A second Compton polarimeter, consisting of two 30 c.c., germanium (GeLi) crystals, has been employed in a comprehensive study of the seventeen levels in ^{61}Ni below 2200 keV. This study has also included lifetime measurements using the Doppler shift attenuation method and gamma ray angular correlation measurements based on Method II of Litherland and Ferguson. The excited states in ^{61}Ni were populated using the ^{58}Fe(alpha,n gamma)^{61}Ni reaction with E/sub alpha/ equals 8.0 MeV. The results of these measurements confirm most of the spin-parity assignments made previously from stripping and pickup reaction studies and studies of the beta$^+$-decay of the ground state of ^{61}Cu. Additional J/sup pi/ assignments of $1/2^-$, $5/2^-$, $3/2^-$, and $1/2^-$ have been made for the levels at 1016, 1611, 1730, and 2020 keV, respectively. The experimental results are compared to recent theoretical calculations made using the shell model and the core coupling model. The experimental M1E2 transition strengths have been found to be in agreement with those measured for other 1f $7/2$ shell nuclei. (Diss. Abstr. Int., B)

8479 ^{25}Mg(^{3}He,α) REACTION AND ROTATIONAL BAND STRUCTURE OF ^{25}Mg. El-Bedewi, F.; Shalaby, M.; Khazbak, A.; Raoof, F. (Ain Shams Univ., Cairo). J. Phys., G (London); 1: No. 7, 749-761(5 Sep 1975).

The ^{25}Mg(^{3}He,α)^{24}Mg reaction has been studied at an incident energy of 18 MeV. Forty-six states in ^{24}Mg have been identified up to an excitation of 12.051 MeV including a new state at 9.650 MeV. Absolute spectroscopic factors extracted from the DWBA analysis of the measured angular distributions indicate that the $1d_{5/2}$ neutron pick up strength is considerably exhausted (79%) for ^{24}Mg states below 12 MeV. Using the rotational model, theoretical spectroscopic factors have been calculated and then compared with the experimentally derived values. Nilsson configurations associated with known positive and negative parity rotational bands are suggested. The isobaric analogue states at 9.980 and 10.070 MeV are identified as the 1^+ and 2^+ member states of the $K^\pi = 1^+$, T = 1 rotational band based on the $5/2 + [202]5/2 + [211]$ configuration. (auth)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstracts 7365, 8444, 8446–8448, 8458, 8468, 8473, 8476, 8496, and 8508.

8480 (KFK-2046, pp 1-32) RESONANCE CAPTURE MEASUREMENTS ON STRUCTURAL MATERIALS WITH LARGE LIQUID SCINTILLATORS. Froehner, F. H. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

3 figs.; 6 tabs.; 19 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

The present status of neutron capture cross section data for structural materials is reviewed as far as they were measured with large liquid scintillator detectors until about 1972, mainly at RPI and KFK. New results from the analysis of KFK data on ^{56}Fe, ^{58}Ni, ^{60}Ni, and ^{61}Ni for neutron energies between 7 and 220 keV are presented, in particular radiation widths and capture areas and also results on the correlation between neutron and radiation widths. Special attention is paid to the estimation of uncertainties. (auth)

8481 (KFK-2046, pp 51-62) ABSOLUTE CAPTURE CROSS SECTION MEASUREMENTS OF Au, Cr, Fe, Ni BETWEEN 70 KeV TO 550 KeV. Le Rigoleur, C.; Arnaud, A.; Taste, J. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

4 figs.; 4 tabs.; 17 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

Total energy weighting technique was used to measure absolute radiative capture cross sections of elemental Cr, Fe, Ni, and Au for neutrons of energy 70 to 550 KeV. A comparison with other data is carried out. (auth)

8482 (KFK-2046, pp 156-189) EVALUATION OF THE NEUTRON CROSS-SECTIONS OF NATURAL NICKEL AND ITS STABLE ISOTOPES BELOW 600 keV. Moxon, M. C. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

5 figs.; 13 tabs.; 67 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

The paper contains general data, resonance parameters, radiation widths and average cross-sections for nickel and its stable isotopes and gives recommendations for further experimental work required. (GE)

8483 (KFK-2046, pp 190-221) THERMAL CROSS SECTIONS AND RESONANCE PARAMETERS RECOMMENDED IN THE NEW BNL 325 VOL. I FOR Cr, Fe, AND Ni. Pearlstein, S. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

The paper consists of a collection of tables containing thermal cross sections, resonance properties and parameters for iron and chromium. (GE)

8484 (KFK-2046, pp 222-250) COMPARISON OF THE KeV-CAPTURE CROSS SECTION FOR Cr, Fe, Ni ON ENDF/B, UKNDL AND KEDAK. Schatz, B. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

With figs.; 6 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

A comparison of the KeV capture data for the structural materials Cr, Fe and Ni is given on the three evaluated nuclear data files ENDF/B, UKNDL and KEDAK in form of diagrams. (GE)

8485 (KFK-2046, pp 349-356) CAPTURE CROSS-SECTIONS OF STRUCTURAL MATERIALS OF IMPORTANCE IN FAST REACTORS. Rowlands, J. L. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

4 figs.; 2 tabs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

Description of the analysis of two integral experiments-null-reactivity test zone method and small sample reactivity perturbation measurements — to determine capture cross sections of structural materials. (GE)

8486 (LA-6116-MS) ENDF/B-IV FISSION-PRODUCT FILES: SUMMARY OF MAJOR NUCLIDE DATA. England, T. R.; Schenter, R. E. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1975. Contract W-7405-Eng-36. 39p. (ENDF-223). Dep. NTIS $4.00.

The major fission-product parameters [sigma/sub th/, RI, tau/sub 1/2/, E-bar/sub beta/, E-bar/sub gamma/, E-bar/sub alpha/, decay and (n,gamma) branching, Q, and AWR] abstracted from ENDF/B-IV files for 824 nuclides are summarized. These data are most often requested by users concerned with reactor design, reactor safety, dose, and other sundry studies. The few known file errors are corrected to date. Tabular data are listed by increasing mass number. (auth)

8487 (LBL-4029) MASS MEASUREMENTS OF HIGHLY NEUTRON-EXCESS NUCLEI IN THE LIGHT ELEMENTS. Wilcox, K. H. (California Univ., Berkeley (USA). Lawrence Berkeley

Lab.). May 1975. Contract W-7405-Eng-48. 102p. Dep. NTIS $6.50.

Thesis.

The $^{26}Mg(^{7}Li,^{8}B)^{25}Ne$ reaction at 78.9 MeV was used to measure the mass-excess of ^{25}Ne (-2.18 +- 0.10 MeV) and several low-lying excited states. Mass-excesses for ^{43}Ar (-31.98 +- 0.07 MeV), ^{45}Ar (-29.727 +- 0.06 MeV), and ^{46}Ar (-29.732 +- 0.07 MeV) were determined from the $^{48}Ca(alpha,^{9,7}Be)^{43-45}Ar$ reactions at 77.7 MeV and the $^{48}Ca(^{6}Li,^{8}B)^{46}Ar$ reaction at 80.1 MeV. Several excited states of ^{43}Ar and ^{45}Ar were observed. These and the excited states of ^{25}Ne are compared with theoretical predictions. Ground state differential cross sections are given for all reactions, ranging from 0.1 to 1 mu b/sr at forward angles. Upper limits of about 1 to 25 nb/sr were determined for the ground state cross sections of the reactions $^{48}Ca(alpha,^{6,10,11}B)^{44,42,41}Cl$ and $^{48}Ca(alpha,^{10-13}C)^{42-39}S$ at 110 MeV. Recoil coincidence techniques were used to measure the mass-excess of the particle-unbound nucleus ^{10}Li(33.83 +- 0.25 MeV) by the $^{9}Be(^{3}Be,^{8}B)^{10}Li$ reaction at 121 MeV; the ground state cross section was 30 nb/sr. The $^{14}C(^{3}Be,^{9}B)^{15}B$ reaction at 120 MeV was also investigated using coincidence techniques. Contamination problems only permitted determining a ground state cross section upper limit of 50 nb/sr. A simple mass relation is derived, similar in approach to the Garvey-Kelson method but taking more explicit account of shell effects. Comparison is made with the Garvey-Kelson relation, and predictions of masses and of the stability of neutron-excess light nuclei are given for both methods. The modified mass relation is shown to offer better account for highly neutron-excess nuclei, including the values reported here for ^{25}Ne and $^{43,45,46}Ar$. (26 figures, 2 tables, 66 references) (auth)

8488 (ZFK-243, pp 23-24) DIFFERENTIAL AND INTEGRATED CROSS SECTIONS FOR THE INELASTIC SCATTERING OF 14-MeV NEUTRONS BY Si, S, Ti, V, Cr, Co, Nb, Ta, AND Au. Hermsdorf, D.; Musiol, G.; Sassonoff, S.; Seeliger, D.; Seidel, K. (Technische Univ., Dresden). Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8489 (ZFK-243, pp 25-27) DETERMINATION OF NUCLEAR TEMPERATURES AND LEVEL DENSITY PARAMETERS FROM THE INELASTIC SCATTERING OF 14-MeV NEUTRONS. Hermsdorf, D.; Musiol, G.; Richter, H. P.; Sassonoff, S.; Seeliger, D.; Seidel, K. (Technische Univ., Dresden). Sep 1972. (In German).

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8490 (ZFK-243, pp 135-138) ROTATIONAL BANDS IN $^{43,45}Sc$, ^{43}Ca, AND ^{45}Ti. May, F. R. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Muenchow, L.; Frauendorf, S. Sep 1972. (In German).

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8491 IMPORTANCE OF THE LOW L PARTIAL WAVES IN HELION INELASTIC SCATTERING. Weisrose, S. A. (King's Coll., London). J. Phys., G (London); 1: No. 7, L53-L56(5 Sep 1975).

A comparison between the DWBA fits to the $^{56}Fe(h,h')^{56}Fe$ reaction at 82.7 MeV with and without a radial cut-off is presented. It is shown that introducing a radial cut-off reduces the contribution of the low L partial waves to the interaction. This produces a poor fit to the data, demonstrating the importance of the nuclear interior. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 7365, 8447, 8480–8485, 8488, 8489, and 8508.

8492 (ANL/NDM-11) MEASURED AND EVALUATED FAST NEUTRON CROSS SECTIONS OF ELEMENTAL NICKEL. Guenther, P.; Smith, A.; Smith, D.; Whalen, J.; Howerton, R. (Argonne National Lab., Ill. (USA); California Univ., Livermore (USA). Lawrence Livermore Lab.). Jul 1975. Contract W-31-109-Eng-38. 159p. Dep. NTIS $11.00.

Fast neutron total and scattering cross sections of elemental nickel are measured. Differential elastic scattering cross sections are determined from incident energies of 0.3 to 4.0 MeV. The cross sections for the inelastic neutron excitation of states at: 1.156 +- 0.015, 1.324 +- 0.015, 1.443 +- 0.015, 2.136 +- 0.013, 2.255 +- 0.030, 2.449 +- 0.030, 2.614 +- 0.020 and 2.791 +- 0.025 MeV are measured to incident neutron energies of 4.0 MeV. The total neutron cross sections are determined from 0.25 to 5.0 MeV. The experimental results are discussed in the context of optical and statistical models. It is shown that resonance width-fluctuation and correlation effects are significant. The present experimental and theoretical results, together with previously reported values, are used to construct a comprehensive evaluated elemental data file in the ENDF format. Some comparisons are made with previously reported evaluated files. In addition, some selected reactions which are widely used in dosimetry and other applications are presented as supplemental evaluated isotopic-data files. The numerical quantities are presented in tabular form. (3 tables, 29 figures) (auth)

8493 (GSI-tr-4/75) DECAY OF ^{77}Rb. Liptak, Ya.; Habenicht, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). May 1975. 6p. (In German). INIS.

5 figs.; 2 tabs.; 6 refs. Available from ZAED. Translated from JINR-P-6-8279, Dubna 1974. To be published in Izv. AN SSSR.

Based on the observed γ-transitions, γ-γ coincidences and on the measured maximum β-energy of the transition in the 66.5 keV state, the decay diagram of $^{77}Rb-^{77}Kr$ is constructed. The log ft values of the β-transitions and the quantum numbers of a few low-lying levels of ^{77}Kr are determined. (GE)

8494 (UCRL-6028-T) EXCITATION FUNCTIONS OF NEUTRON-INDUCED REACTIONS. Tewes, H. A.; Caretto, A. A.; Miller, A. E.; Nethaway, D. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Jun 1960. 13p. (CONF-600901-1). Dep. NTIS $4.50.

From nuclear and radiation chemical symposium; Chalk River, Ontario, Canada (6 Sep 1960).

Cross sections for neutron induced reactions on a variety of nuclei have been measured as a function of neutron energy between 8 and 15 MeV. Tabulations are given of the reactions completed as well as those currently under investigation, cross section measurements to date, and cross sections obtained by others for some of the reactions studied. (2 figures, 3 tables) (SDF)

8495 GAMMA DECAY OF ^{77}Br FROM THE REACTIONS $^{75}As(\alpha,2n\gamma)^{77}Br$ AND $^{77}Se(p,n\gamma)^{77}Br$. Eberth, J. Cologne; Cologne Univ. (1973). 58p. (In German). INIS.

Thesis.

The gamma decay of ^{77}Br was investigated in the reactions $^{77}Se(p,n\gamma)^{77}Br$ and $^{75}As(\alpha,2n\gamma)^{77}Br$. Gamma single spectra, gamma-gamma coincidences and gamma angular distributions were measured. 17 new transitions could be found for which an extended term diagram is proposed. Amongst these, there is a cascade which within the framework of the collective model can be described as rotational bands on the known isomeric $9/2^{+}$-level of ^{77}Br. From the energies and branching ratios of the rotational transitions and their angular distributions, an inner quadrupole moment $Q_0 = -2.05$ barn and a deformation parameter delta = -0.23 are obtained. (GE)

8496 γ-RAY LINES OF RADIONUCLIDES, ORDERED BY ATOMIC AND MASS NUMBER. I. Z = 2–57 (Helium–Lanthanum). Erdtmann, G.; Soyka, W. (Nuclear Research Establishment, Juelich, Ger.). J. Radioanal. Chem.; 26: No. 2, 375-495(1975).

This table contains a complete list of all γ-emitting radionuclides and of all of their γ lines. Additionally, it contains all other lines observable with a γ-ray spectrometer, i.e. the 511-keV lines of the positron annihilation radiation, the escape lines generated in connection with pair production processes of high-energy γ quanta, and most of the x-ray line correlated with radioactive decay. Beside the energies the intensities of the lines are given as far as data have been found in the references cited. If it was possible to find or to calculate the absolute intensity of the γ lines, these values are given, since they are usually more valuable in practical applications. The radionuclide data are supplemented by data concerning the half-life, parent and daughter nuclides, and generating reactions. (auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 6911, 8488, 8489, 8494, 8539, and 8732.

8497 (ZFK-243, pp 40-41) HIGHLY EXCITED ISOMERIC NUCLEAR STATE IN ^{105}Cd. Heiser, C.; Brinckmann, H. F.; Fromm, W. D.; Rotter, H. Sep 1972. (In German).

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8498 (ZFK-243, pp 41-42) TWO NEW ISOMERIC NUCLEAR STATES IN ^{112}In. Brinckmann, H. F.; Fromm, W. D.; Heiser, C.; Rotter, H. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8499 (ZFK-243, pp 42-43) HIGHLY EXCITED ISOMERIC STATE IN ^{117}Sn. Rotter, H.; Brinckmann, H. F.; Fromm, W. D.; Heiser, C. (Sep 1972).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8500 (ZFK-243, pp 44) LIFETIME OF THE HIGHLY EXCITED THIRD ISOMERIC STATE IN ^{118}Sn. Rotter, H.; Brinckmann, H. F.; Fromm, W. D.; Heiser, C. Sep 1972. (In German)
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8501 (ZFK-243, pp 44-46) QUASI-ROTATIONAL BAND IN ^{117}Sb. Fromm, W. D.; May, F. R.; Brinckmann, H. F.; Heiser, C.; Muenchow, L.; Rotter, H. Sep 1972. (In German)
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8502 (ZFK-243, pp 49-50) INVESTIGATION OF THE SPHERICAL ODD-ODD NUCLEI ^{142}Pm AND ^{144}Eu. Funke, L. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Fromm, W. D.; Keller, H. J.; Arlt, R.; Gopytsch, P. M. Sep 1972. (In German)
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8503 (ZFK-243, pp 146) CALCULATION OF QUADRUPOLE-VIBRATIONAL STATES IN ^{116}Sn. Fromm, W. D.; Doenau, F.; Janssen, D. Sep 1972. (In German)
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8504 (ZFK-243, pp 147) CALCULATION OF THE SPECTRUM OF ^{117}Sb IN THE FRAMEWORK OF THE "PARTICLE-VIBRATION COUPLING" MODEL. Fromm, W. D.; Doenau, F.; Janssen, D. Sep 1972. (In German)
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8505 NUCLEAR SPECTROSCOPY WITH (d,p) REACTIONS ON ^{124}Sn, ^{130}Te, ^{140}Ce, AND ^{208}Pb BELOW AND NEAR THE COULOMB BARRIER. Stroemich, A. Cologne; Cologne Univ. (1973). 78p. (In German). INIS.
Thesis.
The reactions ^{124}Sn(d,p)^{125}Sn, ^{130}Te(d,p)^{131}Te, ^{140}Ce(d,p)^{141}Ce and ^{208}Pb(d,p)^{209}Pb were studied by measurements of differential cross sections of the (d,p) reactions and of the elastic deuteron scattering at several energies below and near the Coulomb threshold. By employing scattering potentials which give a good description of the elastic scattering in the entrance and exit channels, the spectroscopic factors and reduced normalization of a total of 28 final states of known spins and parities could be determined with a mean experimental truth of 7.5%, avoiding most of the errors resulting from the many-valuedness of optical potentials. (GE)

8506 DEVELOPMENT OF A NUCLEAR ORIENTATION SYSTEM USING ADIABATIC DEMAGNETIZATION AND THE MEASUREMENT OF THE MAGNETIC MOMENT OF THE GROUND STATE OF ^{105}Rh. Wittkemper, G. Hamburg; Hamburg Univ. (1973). 70p. (In German). INIS.
Thesis.
By adiabatic demagnetization of the paramagnetic salt chromium-potassium-alum, ^{105}Rh was held at 14 mK, and a nuclear orientation was achieved by melting in iron. The decay of ^{105}Rh to ^{105}Pd was investigated and spins of excited ^{105}Pd levels, multipole mixture ratios, and the magnetic moment of ^{105}Rh were measured. (GE)

8507 INVESTIGATION OF THE ELASTIC AND INELASTIC α-SCATTERING FROM SOME CADMIUM AND TELLURIUM ISOTOPES NEAR THE COULOMB BARRIER. Werdecker, D. Cologne; Univ. Cologne (1973). 82p. (In German). INIS.
Thesis.
The elastic and inelastic α-scattering from the isotopes ^{110}Cd, ^{112}Cd, ^{114}Cd, ^{116}Cd and ^{124}Te, ^{126}Te, ^{128}Te is investigated in the region of the Coulomb barrier. The elastic excitation functions at scattering angles of 175°, ±120°, ±60° and the inelastic excitation functions for the first $0^+ \rightarrow 2^+$ transition at the angle 175° were thus measured for these isotopes. The evaluation of the Coulomb excitation within the inelastic excitation gave the B(E2, $0^+ \rightarrow 2^+$) values for these transitions. The experimentally measured cross sections could be fitted to all isotopes in the total energy range between 7 MeV and 17 MeV within the framework of a DWBA analysis using a deformed 4-parameter potential. (GE)

8508 STUDY OF SHORT-LIVED ISOTOPES FOR USE IN NON-DESTRUCTIVE ACTIVATION ANALYSIS. Bode, P.; De Bruin, M.; Korthoven, P. J. M. (Interuniversity Reactor Inst., Delft, Netherlands). J. Radioanal. Chem.; 26: No. 1, 209-213 (1975).
In order to obtain reliable data about short-lived isotopes for use in thermal-neutron activation analysis, experiments were performed with the aid of a fast rabbit transfer system. Half-lives of 28 short-living isotopes were measured by using a counting system with a fixed dead-time. A Ge(Li) spectrometry system was used to determine the most important γ-ray energies and intensities of these isotopes. For the half-lives an accuracy of better than 1% was attained, while for the γ-ray energies the accuracy was 0.1 keV. (2 tables) (auth)

8509 γ-RAY LINES OF RADIONUCLIDES, ORDERED BY ATOMIC AND MASS NUMBER. II. Z = 58-100 (Cerium-Fermium). Erdtmann, G.; Soyka, W. (Nuclear Research Establishment, Juelich, Ger.). J. Radioanal. Chem.; 27: No. 1, 137-286(1975).
This table contains a complete list of all γ-emitting radionuclides and of all of their γ lines. Additionally, it contains all other lines observable with a γ-ray spectrometer, i.e. the 511-keV lines of the positron annihilation radiation, the escape lines generated in connection with pair production processes of high-energy γ quanta, and most of the x-ray lines correlated with radioactive decay. Beside the energies the intensities of the lines are given as far as data have been found in the references cited. If it was possible to find or to calculate the absolute intensity of the γ lines, these values are given, since they are usually more valuable in practical applications. The radionuclide data are supplemented by data concerning the half-life, parent and daughter nuclides, and generating reactions. (auth)

8510 APPLICATION OF NUCLEAR SPECTROSCOPIC TECHNIQUES TO ATOMIC SYSTEMS. Zalutsky, M. R. Seattle; Washington Univ. (1974). 161p. University Microfilms Order No. 75-14,915.
Thesis (Ph. D.)
X-ray angular correlations and Coster-Kronig transition probabilities were measured using cooled, high-resolution Ge(Li) and Si(Li) spectrometers. Angular correlations between K and L x rays in ^{245}Cm, ^{239}Pu, ^{153}Eu, and ^{181}Ta were measured. The x rays of Cm, Pu, Eu, and Ta were obtained from radioactive sources of 352-yr ^{249}Cf, 32-year ^{243}Cm, 242-day ^{153}Eu, and 140-day ^{181}W, respectively. Several corrections to the angular correlation coefficients were made including a correction for the presence of silicon x-ray escape peaks. Angular correlations between L and M x rays in ^{239}Pu obtained from a radioactive source of ^{243}Cm were measured. The anisotropy of Ll x rays and gamma rays of ^{239}Pu following the decay of ^{243}Cm has been investigated. The value of the Coster-Kronig transition probability for Z equals 73 has been determined by 8 variations of the K-L x-ray coincidence technique. The effect of a correction for unwanted L eta-K alpha$_2$ coincidence events in the L alpha-K coincidence spectrum is discussed. The L_2-L_2X Coster-Kronig transition probability for Z equals 63, 94 and 96 has been measured by the L x ray-K x ray coincidence technique. The value measured in ^{63}Eu was corrected for the presence of an unresolved L eta x-ray component in the L alpha x-ray group. The reported values are in agreement with previous measurements but deviate significantly from theoretical predictions. The nuclear level structure of ^{140}Nd has been investigated by studying the decay of 5.8-min ^{140}/sup m/Pm and 10-sec ^{140}/sup g/Pm with Ge(Li) gamma-ray detectors. Decay schemes of ^{140}/sup m/Pm and ^{140}/sup g/Pm were constructed. Evidence for the low-spin members of the two-phonon triplet in ^{140}Nd is also presented. In Appendix C, the nuclear level structure of ^{141}Nd has been investigated by studying the decay of 20.9-min ^{141}Pm produced via the ^{141}Pr(^{3}He,3n) reaction. From the anti-Compton spectra and gamma-gamma coincidence measurements a decay scheme has been constructed which includes 9 previously unreported levels in ^{141}Nd and incorporates 67 of the 70 gamma rays attributed to the decay of ^{141}Pm. The results of this work are compared to recent measurements in other N equals 81 isotones. (Diss. Abstr. Int., B)

8511 ENERGY LEVELS OF ^{93}Nb THROUGH A STUDY OF THE ^{93}Nb(n,n' gamma)^{93}Nb REACTION. Williams, G. H. Austin, TX; Univ. of Texas (1975). 187p. University Microfilms Order No. 75-16,758.
Thesis (Ph. D.).
The measurement of gamma rays produced by the inelastic scattering of neutrons in the ^{93}Nb(n,n' gamma)^{93}Nb reaction is reported. The work provides information on the excited energy levels of the ^{93}Nb nucleus and its associated gamma-ray decay transitions. Differential gamma-ray production cross sections were obtained at incident neutron energies of 0.50 MeV through

1.90 MeV and 3.50 MeV through 5.00 MeV. Angular distribution determinations were made at 1.10 and 1.60 MeV. A revised nuclear energy scheme containing 24 levels through 2.173 MeV is presented. The scheme is constructed from the gamma spectra and experimental excitation functions. Thirty-four of the observed gamma rays can be assigned to transitions between these levels. Comparison of experimental data with calculated theoretical predictions based on the statistical theory and compound-nucleus theory also lead to spin and parity assignments for a number of the energy levels. The gamma rays were measured by a 34cc GeLi spectrometer system used in conjunction with a Van de Graaff 3.2 MeV accelerator as a pulsed neutron source. The spectrometer consisted of a 34cc coaxial GeLi detector centered in a NaI(Tl) annulus and surrounded by a massive shield. Time-of-flight techniques and anticoincidence gating were used to improve the gamma-ray spectra. The spectrometer is described in detail and gamma-ray spectra and production cross section data are given for the ^{27}Al(n,n' gamma), Fe(n,n' gamma) and ^{209}Bi(n,n' gamma) reactions as an illustration of the spectrometer system capabilities. (auth)

8512 RADIATIVE DETECTION NMR OBSERVATIONS OF ISOMERIC NUCLEAR STATES. Whittemore, A. R. Stony Brook, NY; State Univ. of New York (1975). 129p. University Microfilms Order No. 75-16,225.

Thesis (Ph. D.).

The nuclear magnetic moment of the $T_1/_2$ equals 340 mu sec., E equals 3.13 MeV isomer in ^{117}Sb was measured to be 0.1200(7), using the technique of radiative detection of nuclear magnetic resonance (NMR-PAC). This isomer was produced via the ^{115}In (alpha,2n)^{117}Sb reaction in a molten indium target. The nuclear spin-lattice relaxation time was determined to be longer than 2.8 msec. at 240^{0}C. From this value an approximate limit on the nuclear quadrupole moment was deduced. These two results, the g-factor and upper limit on the quadrupole moment, together with other work on this state indicate that the most likely shell model configuration is [pi $d_5/_2$(nu $h_{11}/_2)^2_{6+}$]$_{j25/2+}$. The NMR-PAC technique was also applied to the $T_1/_2$ equals 2.53 msec., E equals 1.571 MeV, 10$^-$ state in ^{208}Bi. The magnetic moment measured is 0.2633(13). Because the configuration is expected to be very pure pi $h_9/_2$nu $i_{13}/_2$, the additivity relation was applied to extract the nu $i_{13}/_2$ magnetic moment. By estimating the M1 core polarization and particle-vibrational admixture in this state, the anomalous orgital g-factor of the neutron delta g/sub l/, was extracted. This procedure is model dependent and the value of delta g/sub l/ falls between -0.05 and -0.03. From the observed amplitude of the NMR-PAC resonance, the nuclear spin-lattice relaxation time and the Knight shift, T/sub R/ equals 0.480(65) msec. and K equals 1.80(23) percent, were deduced. These results are consistent with the systematics of such systems. Diss. Abstr. Int., B.

8513 PROTON STRIPPING REACTIONS POPULATING LEVELS IN ^{95,97,101}Tc. Cheung, H. C.; Kitching, J.; Lee, J. K. P.; Mark, S. K. (McGill Univ., Montreal). J. Phys., G (London); 1: No. 7, 737-748(5 Sep 1975).

The structure of the low-lying levels of ^{95,97,101}Tc was investigated with the proton stripping (^{3}He,d) reaction. The experimental angular distributions were compared with distorted-wave Born-approximation calculations, and l-values and spectroscopic factors were extracted. The proton configurations of the target ground states were deduced. The systematics of transition strength distributions are discussed. (auth)

8514 THEORETICAL INVESTIGATION OF THE STRUCTURE OF ODD-MASS TELLURIUM ISOTOPES IN THE UNIFIED NUCLEAR MODEL. di Rienzi, J. Brooklyn; Polytechnic Inst. of Brooklyn (1975). 129p. University Microfilms Order No. 75-21,359.

Thesis (Ph. D.).

Recently observed experimental data on the low energy spectra, mean lifetimes, nuclear moments, and spectroscopic factors of odd-mass tellurium isotopes are investigated in detail within the framework of the particle-vibration coupling approach in the unified nuclear model. Within this approach, it is assumed that the last odd nucleon, in the present work a neutron, has available to it several single particle states and is coupled to the quadrupole surface vibrations of the even-even core. Even mass tellurium nuclei are taken to form the corresponding cores. The last odd neutron in the tellurium isotopes is considered according to the shell model to occupy the 2d/sub 3/2/ and 3s/sub 1/2/ orbits. The parameters which enter into the calculations are the quadrupole phonon energy, h omega/2 pi, of the even-even core; the coupling strength xi, and the relative energy spacing between single particle levels, epsilon. The value of h omega/2 pi is taken from the spectrum of the corresponding core nucleus, and xi and epsilon are varied within reasonable limits to obtain the best fit to the observed spectra of ^{121}Te, ^{123}Te, ^{125}Te, ^{127}Te, ^{129}Te, and ^{131}Te. The theoretical results are in generally good agreement with the available experimental data. The wavefunctions obtained from the model are used to calculate the electromagnetic transition probabilities, mixing ratios, lifetimes, and nuclear moments for the low-lying states in each of the nuclei considered. Two sets of calculations are made in that the nuclear deformation parameter C is determined two ways. First, C is found from the shell model approximation of the radial coupling function, and then it is determined from the experimental mean life-times of the double-even cores. (Diss. Abstr. Int., B)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 8488, 8494, 8509, 8510, 8556, and 8557.

8515 (UCID-16958) INVESTIGATION OF THE DEPENDENCE OF gamma-RAY SPECTRAL SHAPE ON THE AVERAGING INTERVAL SIZE FOR THE ^{181}Ta(n,gamma) REACTION. Stelts, M. L.; Browne, J. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Nov 1975. Contract W-7405-Eng-48. 12p. Dep. NTIS $4.50.

The dependence of the shape of neutron capture gamma-ray spectra on the averaging interval size has been investigated for the ^{181}Ta (n,gamma) reaction. The effects of statistical fluctuations in the partial radiation widths are discussed. The change in the spectral shape as a function of neutron energy is presented. (auth)

8516 (ZFK-243, pp 51-52) CALCULATION OF TRANSITION PROBABILITIES IN THE GROUND-STATE BAND OF THE NUCLEUS ^{161}Ho. Winter, G.; Funke, L.; Kemnitz, P.; Sodan, H. Sep 1972.

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8517 (ZFK-243, pp 54-57) ROTATION-PARTICLE COUPLING OF BANDS WITH POSITIVE PARITY IN ^{163}Ho AND ^{161}Ho. Funke, L.; Kaun, K. H.; Kemnitz, P.; Sodan, H.; Winter, G. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8518 (ZFK-243, pp 58-59) STUDY OF THE DEFORMED ODD-ODD NUCLEI ^{162}Ho AND ^{164}Ho. Walther, K.; Funke, L. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8519 (ZFK-243, pp 60-63) ISOMERISM STUDIES IN ^{159}Dy AND ^{163,165}Er. Andrejtscheff, W.; Manfrass, P.; Schilling, K. D. Sep 1972. (In German).

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8520 (ZFK-243, pp 63-65) MIXED ROTATIONAL BAND OF POSITIVE PARITY AND ABSOLUTE E1 TRANSITION PROBABILITIES IN Dy AND Er ISOTOPES. Andrejtscheff, W.; Manfrass, P.; Schilling, K. D. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8521 (ZFK-243, pp 66-67) 1/2-[541] BAND IN ^{167}Tm. Winter, G.; Funke, L.; Kaun, K. H.; Kemnitz, P.; Sodan, H. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8522 (ZFK-243, pp 68-70) DESCRIPTION OF THE 1/2-[541] ROTATIONAL BAND IN THE NUCLEI ^{171}Lu AND ^{173}Lu. Kemnitz, P.; Funke, L.; Kaun, K. H.; Sodan, H.; Winter, G.; Baznat, M. I. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8523 (ZFK-243, pp 70-71) EXCITATION OF ROTATIONAL STATES IN ^{171}Lu AND ^{173}Lu. Kemnitz, P.; Funke, L.; Kaun, K. H.; Sodan, H.; Winter, G. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic))

8524 (ZFK-243, pp 73-75) DE-EXCITATION OF THE 1/2$^-$[541] AND 1/2$^+$[411] BANDS IN ^{177}Lu. Manfrass, P.; Andrejtscheff, W. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8525 (ZFK-243, pp 77-78) E1 TRANSITIONS BETWEEN 5/2$^-$[512] AND 7/2$^+$[633] STATES. Andrejtscheff, W.; Manfrass, P.; Schilling, K. D. Sep 1972. (In German)

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8526 (ZFK-243, pp 79-80) ROTATIONAL LEVELS IN ^{179}Hf. Allam, S.; Sodan, H.; Winter, G. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8527 (ZFK-243, pp 80-81) DETERMINATION OF THE LIFETIMES OF THE $1/2^+$[411], $1/2^+$[402], AND $5/2$ $1/2^-$[541] LEVELS IN ^{179}Ta. Manfrass, P.; Andrejtscheff, W.; Schilling, K. D.; Will, E. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8528 (ZFK-243, pp 82-84) HINDERED E1 AND M1 TRANSITIONS IN Lu AND Ta ISOTOPES WITH ODD MASS NUMBER. Schilling, K. D.; Andrejtscheff, W.; Manfrass, P. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8529 (ZFK-243, pp 86-88) HINDERED ELECTRIC DIPOLE AND QUADRUPOLE TRANSITIONS IN ^{182}Ta. Seidel, W.; Andrejtscheff, W.; Manfrass, P. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8530 (ZFK-243, pp 89-91) STUDY OF ^{185}W WITH THE (n, γ) REACTION. Prade, H.; Mohsen, M.; Beitins, M.; Manfrass, P. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden(German Democratic Republic)).

8531 (ZFK-243, pp 91-93) BAND STRUCTURE AND ELECTROMAGNETIC TRANSITION PROBABILITIES IN $^{183\ 185\ 187}$W. Andrejtscheff, W.; Prade, H. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8532 (ZFK-243, pp 93-96) SYSTEMATIC STUDIES ON MECHANISM OF NEUTRON CAPTURE IN DEFORMED DOUBLY EVEN TARGET NUCLEI IN THE MASS REGION 164 ≤ TO A ≤ TO 186. Mohsen, M.; Rudolph, W.; Prade, H. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8533 (ZFK-243, pp 97-98) ^{179}Re DECAY AND THREE-QUASI-PARTICLE LEVELS IN ^{179}W. Arlt, R. (Vereinigtes Institut fuer Kerforschung, Dubna, USSR); Bajor, B.; Wylov, Z. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossemdorf bei Dresden (German Democratic Republic)).

8534 (ZFK-243, pp 98-99) LIFETIME OF THE $5/2$ $1/2^-$[541] LEVEL IN ^{183}Re. Manfrass, P.; Andrejtscheff, W.; Schilling, K. D. Sep 1972.
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8535 (ZFK-243, pp 99-101) ROTATIONAL LEVELS IN ^{185}Os. Sodan, H.; Fromm, W. D.; Funke, L.; Kemnitz, P.; Kaun, K. H.; Winter, G. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic).

8536 (ZFK-243, pp 101-102) ISOMERIC LEVELS IN ^{188}Os. Manfrass, P.; Andrejtscheff, W.; Kaeubler, L.; Schilling, K. D. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8537 (ZFK-243, pp 130-132) PROJECTION DESCRIPTION OF γ BANDS (K = 2) IN EVEN-EVEN NUCLEI AND ROTATIONAL BANDS IN ODD-ODD NUCLEI. May, F. R. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Muenchow, L.; Frauendorf, S. Sep 1972. (In German).
In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8538 EXPERIMENTAL DETERMINATION OF ^{187}Re AND ^{195}Au TERM DIAGRAMS. Farzine, K. Bochum, Ger.; Univ. Bochum (1973). 112p. (In German). INIS.
Thesis.
The γ-radiation from the β-decay of ^{187}W and the EC-decays of ^{195}Hg, ^{195m}Hg are investigated to explain the term diagrams of ^{187}Re or ^{195}Au. All coincidences and their intensities are thus evaluated. By means of calculated logft values and of the branching ratios of the transitions, the levels, spins and parities are assigned. The term diagram of ^{187}Re is compared with nuclear model predictions. The best description of level and transitions is achieved by a Nilsson model which takes account of the Coriolis interaction. (GE)

8539 PROTON SCATTERING ON THE STABLE EVEN SAMARIUM ISOTOPES AT 25 MeV. Pegel, C. Hamburg; Hamburg Univ. (1973). 53p. (In German). INIS.
Thesis.
Elastic and inelastic proton scattering was measured on the five even samarium isotopes ^{144}Sm, ^{148}Sm, ^{150}Sm, ^{152}Sm, and ^{154}Sm with an injection energy of E_p = 25.6 MeV. The parameters of the optical potential were investigated as a function of the increasing neutron excess of the target nuclei. The simple phenomenological optical model (SOM) allows the description of the expected dependence of the surface potential of the imaginary part of its diffusion parameter on the symmetry term (N − Z)/A, but not of a desired dependence of the real central potential. (GE)

8540 DEFORMATION PARAMETERS FROM INELASTIC SCATTERING NEAR AND BELOW THE COULOMB BARRIER. Lee, I. Y. Pittsburgh; Univ. of Pittsburgh (1974). 107p. University Microfilms Order No. 75-18,246.
Thesis (Ph. D.)
Excitation functions for the 0^+, 2^+ and 4^+ states of the ground bands of ^{168}Er, ^{184}W and ^{186}W were measured at 140^0 173.5^0 with incident alpha-particle energies ranging from 12.5 to 19 MeV. At higher energies destructive nuclear Coulomb interference effects were observed, in particular very deep minima were found in the 4^+ excitation functions of the W-isotopes. A coupled channel program was developed in order to interpret the data. Reduced E2 and E4 matrix elements and the deformation parameters beta$_2$/sup N/ and beta$_4$/sup N/ of the optical potential were derived from the experimental results. Similar data of a group from the Oak Ridge National Laboratory on ^{154}Sm, ^{166}Er and ^{182}W were also analysed using this program. A comparison of the deformation parameters determined in the present analysis with those from other experiments and theoretical calculations are presented. This program was also used in the analysis of the excitation functions of the 0^+ and 2^+ states of ^{24}Mg in ^{16}O scattering. The dependence of the shape of the excitation function on the nuclear properties was investigated. (auth)

8541 MAGNETIC MOMENT MEASUREMENTS OF SOME NUCLEAR LEVELS IN ^{155}Gd, ^{156}Gd, AND ^{160}Dy. Khan, S. N. (Sussex Univ., Brighton, Eng.); Fox, R. A.; Hamilton, W. D.; Finger, M. J. Phys., G (London); 1: No. 7, 727-736(5 Sep 1975).
Magnetic moments of levels in ^{155}Gd, ^{156}Gd, and ^{160}Dy have been measured using IPAC and employing the hyperfine field experienced by these nuclei when embedded in ferromagnetic gadolinium metal. The sources were kept at 4 K and the external polarizing field was produced by a superconducting coil. The results, expressed in nuclear magnetons, are 0.07 ± 0.02 (^{155}Gd; 105 keV), 1.32 ± 0.36 (^{156}Gd; 288 keV), 3.14 ± 0.40 (^{156}Gd; 1511 keV), 1.48 ± 0.60 (^{160}Dy; 284 keV) and 0.32 ± 0.14 (^{160}Dy; 966 keV). The result for ^{155}Gd removes an inconsistency in previous measurements and the other results are in good agreement with earlier experiments. The measurements show that perturbed directional correlation measurements may be successfully made for rare earth nuclei which are dissolved in gadolinium metal. (auth)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 8441, 8481, 8489, 8505, 8509, 8512, and 8538.

8542 (COO-1672-61) RADIOCHEMICAL INVESTIGATIONS OF NUCLEAR PROPERTIES. Progress report, 1 October 1974-30 September 1975. Daly, P. J. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Chemistry). Sep 1975. Contract AT(11-1)-1672. 20p. Dep. NTIS $4.50.
Further studies of the structure of nuclei in the A equals 180-200 shape transitional region have been performed. The principal project completed during the current year was an extensive in-beam gamma-ray investigation of high-spin levels in the nine nuclei ^{188}Pt to ^{194}Pt by (alpha,xn gamma) reactions on enriched Os targets. Acute backbending observed in the positive parity yrast sequences of ^{188,190,192,194}Pt has been attributed to the intersection of rotation-aligned (nu i^{-2}/sub 13/2/) and (pi h^{-2}/sub 11/2/) bands with the ground bands. In all four odd-A Pt nuclei, decoupled nu i^{-1}/sub 13/2/ bands and many other low-lying high-spin positive parity levels have been established, and low-spin positive parity levels have been located in complementary decay studies. A model of an i/sub 13/2/ neutron hole coupled to a triaxially deformed core has been found to be rather successful in reproducing these complex level spectra. Other topics dealt with include new mu s isomers in ^{187,189,191}Pt, the decays of ^{191}Au,

/sup 194m/Ir and 1.7 h ^{186}Ir and the level structure of ^{191}Au from an ^{191}Ir(alpha,4n gamma) study. (auth)

8543 NUCLEAR RESPONSE WITH A NEW SKYRME INTERACTION. Liu, K. F. Stony Brook, NY; State Univ. of New York (1975). 148p. University Microfilms Order No. 75-16,209.

Thesis (Ph.D.).

A combined velocity and density dependent term is introduced in the Skyrme interaction in order to have an improved level density of the single-particle spectrum in ^{208}Pb. The response function built on the Hartree-Fock ground states in the frame work of the random phase approximation is calculated with a fast numerical method by working in coordinate space. Positions of many giant resonances are reproduced within 4 percent of the experimental values. The transition rates of the low-lying states are in general within 12 percent of the experimental values except for the 3$^-$ state in ^{16}O. Most of the energy-weighted sum rules are exhausted by the calculated strength of the giant resonances. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 8509 and 8510.

8544 (CONF-750303-76) MANGANESE BATH SYSTEMATIC EFFECTS IN MEASUREMENTS OF Nu-BAR AND ETA. Smith, J. R. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA). Idaho National Engineering Lab.). 1975. 4p. Dep. NTIS $4.50.

From proceedings on nuclear cross section and technique; Washington, District of Columbia, USA (3 Mar 1975).

Measurements using the manganese bath technique are central to the discrepancy that has existed between measured values of nu-bar for ^{252}Cf. Manganese bath measurements of nu-bar belong to the lower group of values, while the eta measurements are consistent with the higher nu-bar values. A three-part study was performed to see if the discrepancy could be explained by differences in manganese bath techniques: (1) A ^{252}Cf source previously calibrated by De Volpi was calibrated in the MTR manganese bath; (2) The recommendations made by De Volpi for altering the MTR eta values were carefully considered; and (3) The results of the Monte Carlo calculation of the MTR experiments, carried out at Bettis Atomic Power Laboratory, were examined in detail. The study produced insignificant changes in the eta values. (6 tables) (auth)

8545 (CONF-751104-2) GENERAL SURVEY OF APPLICATIONS WHICH REQUIRE ACTINIDE NUCLEAR DATA. Raman, S. (Oak Ridge National Lab., Tenn. (USA)). 1975. 84p. Dep. NTIS $6.00.

From IAEA advisory group meeting on transactinium isotope nuclear data; Karlsruhe, F. R. Germany (3 Nov 1975).

The actinide waste problem, the buildup of toxic isotopes in the fuel, the neutron activity associated with irradiated fuel, the ^{252}Cf buildup problem, and the production of radioisotope power sources as broad areas that require actinide cross-section data are reviewed. Decay data enter into the area of radiological safety and health physics. A few cross-section measurements in progress at the Oak Ridge Electron Linear Accelerator are also discussed. The availability of actinide samples through the Transuranium Program at Oak Ridge is discussed in considerable detail. The present data status with respect to the various applications is reviewed along with recommendations for improving the data base. (auth)

8546 (UCRL-51925) MEASUREMENT OF THE NEUTRON-INDUCED FISSION CROSS SECTION OF ^{241}Pu RELATIVE TO ^{235}U FROM 0.001 TO 30 MeV. Behrens, J. W.; Carlson, G. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Oct 1975. Contract W-7405-Eng-48. 27p. Dep. NTIS $4.00.

The ratio of the neutron-induced fission cross sections of ^{241}Pu relative to that of ^{235}U was measured with fission ionization chambers at the LLL 100-MeV electron linear accelerator. The time-of-flight technique was used to measure the cross-section ratio as a function of neutron energy from 0.001 to 30 MeV. The continuous energy spectrum of the neutron source allowed us to cover the entire energy range in one measurement. Pulse height distributions were also measured as functions of energy over broad energy bands. These data were used to estimate the energy variation in the efficiency to be less than 0.75 percent. The threshold cross-section method normalized the ratio independent of other cross-section measurements to 1.268 +- 0.022 in the interval 1.75 to 4.00 MeV. The ratio was also taken to thermal neutron energy where it was normalized to evaluated thermal fission cross sections and the resulting ratio in the 1.75- to 4.00-MeV interval was 1.242 +- 0.021. Corrected for the impurities in the ^{241}Pu sample, the average of these two values resulted in a ^{241}Pu:^{235}U fission cross-section ratio of 1.251 +- 0.016 for the normalization interval. Typical energy resolution is 5 percent at 20.0, 1.0, and 0.1 MeV. Most of the data have counting uncertainties smaller than 4 percent, expressed as a standard deviation. Systematic errors are discussed, and current results are compared with previous measurements. Tables of our data are included. (9 tables, 8 figures) (auth)

8547 CUMULATIVE FISSION YIELDS OF ^{252}Cf. Blachot, J.; Cavallini, P.; Ferrieu, A.; Louis, R. (CEN, Grenoble, France). J. Radioanal. Chem.; 26: No. 1, 107-125(1975). (In French)

The cumulative yields of 28 isotopes were measured in the spontaneous fission of ^{252}Cf. Measurements were made by Ge(Li) gamma spectrometry. An average number of neutrons per fission ν-bar = 3.71 was derived from the mass distribution. By use of Terrell's method, and with the mass distribution before neutron emission, measured in another laboratory and with the present results, the mass-dependent variation of ν-bar was also deduced. (6 figures, 5 tables) (auth)

8548 SPONTANEOUS FISSION RATE OF ^{238}U AND FISSION TRACK DATING. Wagner, G. A. (Max-Planck-Institut fuer Kernphysik, Heidelberg); Reimer, G. M.; Carpenter, B. S.; Faul, H.; van der Linden, R.; Gijbels, R. Geochim. Cosmochim. Acta; 39: No. 9, 1279-1286(Sep 1975).

The rate of spontaneous fission decay of uranium-238 was determined in 4π-geometry by the fission track method. Uranium glasses of known age of manufacture were used. Spontaneous tracks have accumulated since the time of manufacture and induced tracks to determine the uranium content were produced by thermal neutron irradiations. Spontaneous tracks in all glasses were found to be partially annealed. By correcting for this annealing effect, a spontaneous fission rate of $8.7 \pm 0.6 \times 10^{-17}$ yr^{-1} was obtained. Uncertainty in the neutron dose is the largest source of error. (auth)

8549 INDEPENDENT YIELDS OF Rb AND Cs ISOTOPES FROM THE FISSION OF NATURAL URANIUM INDUCED BY PROTONS OF ENERGY 80 AND 100 MeV. Lee, J. K. P.; Pilar, G.; Tracy, B. L.; Yaffe, L. (McGill Univ., Montreal). J. Inorg. Nucl. Chem.; 37: No. 10, 2035-2038(Oct 1975).

The independent yields or production cross sections of rubidium isotopes from mass 86 to 97, and of cesium isotopes from mass 129 to 144, have been measured for the fission of natural uranium induced by 80 and 100 MeV protons. The results were obtained by means of an on-line mass spectrometer. The rubidium distributions are quite symmetric, whereas the cesium distributions show a definite skewness toward the heavy mass side. Comparison with other results at 40, 50, 60 and 150 MeV proton energies shows that the heavy mass sides of the isotopic distributions are relatively insensitive to proton energy, whereas the light mass sides shift downward with increasing proton energy. The average total number of neutrons emitted has been estimated for each fission reaction. The mechanism of nuclear charge division in 80 and 100 MeV proton fission in the mass split studied here appears to be similar to that operating in thermal-neutron and low-energy proton fission. (auth)

Nuclear Theory

Refer also to abstracts 8172, 8368, 8430, 8465, and 8627.

8550 (HMI-B-169) INTERFERENCE IN DIRECT HEAVY ION REACTIONS. von Oertzen, W. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany). Bereich Kern- und Strahlenphysik). Apr 1975. 46p. INIS.

25 figs.; 26 refs. Lectures given at the 4th INS Summer school on Nuclear Physics on Izy Peninsula, Japan, Mar 1975.

Using the superposition principle the interference of different branches are discussed in scattering and reaction processes. In elastic and inelastic scattering different phase rules result if the coherent contributions arise at the same or different "sides" of the target nucleus. In transfer processes there can be two (or more) coherent contributions, which are interelated by anti-symmetrisation. The scattering of identical nuclei, nearly identical nuclei (elastic transfer) and reactions, in which identical nuclei (or nearly identical nuclei) as well as isospin multiplet members are produced, are discussed. Phase rules with respect to the behavior of angular distributions at 90° cm and their dependence on the properties of the reaction process are obtained which are similar to those found in scattering processes. It is found that with the application of the generalized Pauli principle for composite objects the reaction mechanism has to be considered. (auth)

8551 (LBL-4296) MACROSCOPIC DESCRIPTION OF THE INTERACTION BETWEEN TWO COMPLEX NUCLEI. Swiatecki, W. J. (California Univ., Berkeley (USA). Lawrence Berkeley

Lab.). Sep 1975. Contract W-7405-Eng-48. 13p. (CONF-750938-2). Dep. NTIS $4.50.

From seminar on reactions of heavy ions with nuclei and synthesis of new elements; Dubna, USSR (23 Sep 1975).

Assuming that the particle number is large, and using the leptodermous idealization that the ratio of the surface thickness to the cube root of nuclear volume is very small, an attempt is made to give an account of the time evolution of the shape of a nuclear system. It is suggested that a one-body, dissipation dominated approach to nuclear dynamics should be a reasonable starting point. (SDF)

8552 (LBL-4317) NUCLEAR INTERACTION POTENTIAL IN A FOLDED-YUKAWA MODEL WITH DIFFUSE DENSITIES. Randrup, J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1975. Contract W-7405-Eng-48. 38p. Dep. NTIS $4.00.

The folded-Yukawa model for the nuclear interaction potential is generalized to diffuse density distributions which are generated by folding a Yukawa function into sharp generating distributions. The effect of a finite density diffuseness or of a finite interaction range is studied. The Proximity Formula corresponding to the generalized model is derived and numerical comparison is made with the exact results. (8 figures) (auth)

8553 (ORO-4856-22) QUASIPARTICLE INTERACTION IN NUCLEAR MATTER. Poggioli, R. S.; Jackson, A. D. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy; New York Univ., N. Y. (USA). Dept. of Physics). Jul 1975. 51p. Dep. NTIS $5.50.

A microscopic calculation of the quasiparticle interaction in nuclear matter is detailed. In order to take especial care of the contributions from the low momentum states, a model space is introduced. Excluded from the model space, the high momentum states are absorbed into the model interaction. Brueckner theory suggests the choice of a truncated G-matrix as a good approximation for this model interaction. A simple perturbative approach is attempted within the model space. The calculated quasiparticle interaction is consistent with experimental results. (11 tables, 14 figures) (auth)

8554 (ORO-4856-36) VERTEX AND PROPAGATOR RENORMALIZATIONS IN NUCLEAR CALCULATIONS. Poggioli, R. S. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Oct 1975. 7p. Dep. NTIS $4.50.

It has been asserted that vertex renormalizations tend to cancel the effects of propagator renormalizations in nuclear calculations. In order to test this hypothesis, those contributions to the quasiparticle interaction in nuclear matter which represent the effect of the simplest vertex and propagator renormalizations have been evaluated. Unfortunately, almost no cancellation of effects was found to exist. (auth)

8555 (ZFK-243, pp 117-118) COMPARISON OF DIFFERENT METHODS FOR THE CALCULATION OF STRIPPING REACTIONS TO UNBOUND FINAL STATES. El-Naiem, A.; Barz, H. W. Sep 1972. (In German).

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8556 (ZFK-243, pp 127-129) DESCRIPTION OF THE DECOUPLING EFFECT IN ROTATIONAL BANDS WITH K ≠ to ½ IN THE FRAMEWORK OF THE PROJECTION METHOD. May, F. R. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Muenchow, L.; Frauendorf, S. Sep 1972. (In German).

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)).

8557 (ZFK-243, pp 132-135) ΔK ≠ TO 1 BAND-MIXING IN ODD NUCLEI AND ATTENUATION FACTORS. May, F. R. (Zentralinstitut fuer Kernforschung, Rossendorf, Ger.); Muenchow, L.; Frauendorf, S. Sep 1972. (In German).

In joint annual report, 1972. (Zentralinstitut fuer Kernforschung, Rossendorf, bei Dresden (German Democratic Republic)).

8558 GENERAL EQUATIONS FOR CORRELATION FUNCTIONS AND THEIR RELATIONSHIP TO THE BRUECKNER–BETHE THEORY. Luehrmann, K. H. Bochum, Ger.; Bochum Univ. (1973). 132p. (In German). INIS.

Thesis.

The main topic of this work is the derivation of a hierarchy of equations for the correlation functions (exp(S) formalism), their interpretation and comparison with the Brueckner-Bethe theory. It is shown that the Brueckner-Bethe theory in the exp(S) statement can be reproduced to a remarkable extent. (GE)

8559 AN ODD–EVEN AND ODD–ODD NUCLEAR MODEL WITH OSCILLATING CORE APPLIED ON THE NUCLEI $_{10}Ne^{21}$, $_{11}Na^{21}$ AND $_{11}Na^{22}$. Buettner, W. Erlangen, Ger.; Erlangen-Nuernberg Univ. (1973). 153p. (In German). INIS.

Thesis.

In the odd-even and odd-odd nuclear model discussed in this paper, the even-even core is described as an oscillating dumbbell consisting of two spinless particles of equal mass at a distance rho. A rho-dependent potential V(rho) makes the two dumbbell masses oscillate at an equilibrium distance. An extension of the dumbbell model to even-odd, odd-even and odd-odd nuclei was achieved by putting the outer nucleons in a Nilsson potential with the dumbbell axis as a symmetry axis. The deformation β of this Nilsson potential oscillates around a mean value as a function of the dumbbell length rho. (GE)

8560 TOTAL ACTIVITY MAXIMUM OF RADIOACTIVE CHAINS. Baisenc, L.; Beller, R.; Laplace, J. (Univ., Geneva). J. Radioanal. Chem.; 26: No. 1, 87-95(1975). (In German)

The total activity of a radioactive decay chain presents a maximum in many cases, but the maximum can seldom be observed. General equations are developed, which take into account branching ratios, emissions, formation and counting yields. This mathematical model is applicable by analogy to other systems with the same kinetics. (7 figures) (auth)

8561 SEMICLASSICAL APPROXIMATIONS TO 3j- AND 6j-COEFFICIENTS FOR QUANTUM-MECHANICAL COUPLING OF ANGULAR MOMENTA. Schulten, K.; Gordon, R. G. (Harvard Univ., Cambridge, MA). J. Math. Phys. (N. Y.); 16: No. 10, 1971-1988(Oct 1975).

The coupling of angular momenta is studied using quantum mechanics in the limit of large quantum numbers (semiclassical limit). Uniformly valid semiclassical expressions are derived for the 3j (Wigner) coefficients coupling two angular momenta, and for the 6j (Racah) coefficients coupling three angular momenta. In three limiting cases the new expressions reduce to those previously conjectured. The derivation involves solving the recursion relations satisfied by these coefficients by a discrete analog of the WKB method. Terms of the order of the inverse square of the quantum numbers are neglected in the derivation, so that the results should be increasingly accurate for larger angular momenta. Numerical results confirm this asymptotic convergence. Moreover, the results are of a useful accuracy even at small quantum numbers. (3 figures, 5 tables) (auth)

8562 EXACT RECURSIVE EVALUATION OF 3j- AND 6j-COEFFICIENTS FOR QUANTUM-MECHANICAL COUPLING OF ANGULAR MOMENTA. Schulten, K.; Gordon, R. G. (Harvard Univ., Cambridge, MA). J. Math. Phys. (N. Y.); 16: No. 10, 1961-1970(Oct 1975).

Algorithms are developed for the exact evaluation of the 3j coefficients of Wigner and the 6j coefficients of Racah. These coefficients arise in the quantum theory of coupling of angular momenta. The method is based on the exact solution of recursion relations in a particular order designed to guarantee numerical stability even for large quantum numbers. The algorithm is more efficient and accurate than those based on explicit summations, particularly in the commonly arising case in which a whole set of related coefficients is needed. (4 figures, 4 tables) (auth)

8563 IRREDUCIBLE CARTESIAN TENSOR EXPANSIONS OF SCALAR FIELDS. Moraal, H. (Univ., Cologne). J. Math. Phys. (N. Y.); 16: No. 8, 1550-1555(Aug 1975).

It is shown how a scalar function V(parallel R + SIGMA/sub i equals 1/sup n/ a/sub i/parallel) of a sum of n + 1 vectors can be expanded as a multiple Cartesian tensor series in the vectors a/sub i/. This expansion is a rearrangement of the multiple Taylor series expansion of such a function. In order to prove the fundamental theorem, generalized Cartesian Legendre polynomials are defined. The theorem is applied to the eigenfunctions of the Laplace operator and to inverse powers. The expansion of the latter type of function leads to forms involving generalized hypergeometric functions in several variables. As a special case, the Cartesian form of the multipole expansion of the electrostatic potential between two linear molecules is derived. A number of sum rules for hypergeometric functions and addition formulas for (standard and modified) spherical Bessel functions are proved by using a reduction property of the generalized Legendre polynomials. The case of the expansion of a tensorial function is also briefly discussed. (auth)

8564 TOWARD A FUNDAMENTAL MECHANICS. I. Phipps, T. E. Jr. (Naval Surface Weapons Center, White Oak, MD). Found. Phys.; 5: No. 1, 45-58(Mar 1975).

A conceptual purification of physics is advocated, whereby the idea of the field is completely eliminated in favor of particulate dynamical laws. Previous work concerning a specific formulation of such purely mechanical laws is reviewed and is shown to imply the possibility of existence of electrons and positrons within nuclei

or "elementary" particles in stable bound states characterized by real mass-energy and imaginary momentum. The qualitative implications and the sufficiency of such concepts for physical description is examined. (auth)

8565 STUDY OF ATOMIC NUCLEI FAR AWAY FROM THE STABILITY CURVE. Yang, F. C. (Futan Univ., China). Wu-li; 4: No. 1, 38-40(Feb 1975). (In Chinese)

This is an introductory review article. It is pointed out that the study of these nuclei may provide insights to some fundamental problems in nuclear structure and lead to useful new isotopes and even "clean" fissionable elements. Current researches at CERN, Oak Ridge and other laboratories are mentioned. The problems for research include the shape and structure of such nuclei and their relationship to theoretical models; new isotopes; α and proton decays of some nuclei; Q value and nuclear mass; and the search for light fissionable elements. (JPRS)

8566 COLLECTIVE MOTION OF NUCLEI AND THE QRPA. Chen, C. C. (Nanking Univ., China). Wu Li Hsueh Pao; 24: No. 4, 281-290(Jul 1975). (In Chinese)

This article generalizes the RPA theory of nuclei rotation to QRPA (quasi random particle approximation) to include the nuclei surface form vibration and counter-vibration as well as the collective rotation of deformed nuclei within the framework of the same theory. (JPRS)

8567 BOUND STATE PROPERTIES OF THE THREE-NUCLEON SYSTEM WITH THE REID SOFT-CORE POTENTIAL. Brandenburg, R. A. Lafayette, IN; Purdue Univ. (1974). 73p. University Microfilms Order No. 75-17,162.

Thesis (Ph. D.).

The Faddeev equations are solved for the bound state of three nucleons, with the two nucleon interaction taken to be the entire Reid soft-core potential. The solutions of the angular momentum reduced Faddeev equations were used to generate a twenty-seven component, fully antisymmetrized wave function for the ground state. The probabilities of the partial wave components are P(S) equals 89.58 percent, P(S') equals 1.60 percent, P(D) equals 8.77 percent, and P(P) equals 0.05 percent. The binding energy of the triton was found to be 6.9 MeV. The wave function was used to generate the ^{3}He charge and magnetic form factors in the impulse approximation. The charge form factor F/sub CH/(Q^2), was calculated with the nonrelativistic charge density operator, and also with the Darwin-Foldy and spin-orbit relativistic corrections. The effects of the relativistic terms were found to be small. The calculated absolute value (F/sub CH/(Q^2) has a minimum at about Q^2 equals 18 fm^{-2}, while the experimental results show a minimum at 11.8 fm^{-2}. The magnetic form factor F/sub MAG/(Q^2) was calculated with both the magnetic-spin current and convection current operators. The major contribution came from the magnetic-spin term, with the S-D matrix elements contributing significantly. The convection current contribution was found to be small. The calculated absolute value F/sub MAG/(Q^2) predicts a minimum at about Q^2 equals 7.1 fm^{-2}, in disagreement with the experimental data which has no minimum. (auth)

8568 CHARGE ASYMMETRY OF T equals 1 STATES OF THE A equals 42 NUCLEI. Sato, H. New Brunswick, NJ; Rutgers--the State Univ. (1975). 107p. University Microfilms Order No. 75-17,472.

Thesis (Ph. D).

According to the proposed general treatment, the isobaric multiplet energy shifts (IMES) of T equals 1, J equals 0_1^+, 2_1^+, 0_2^+, 2_2^+, 4_1^+, 6_1^+ and 4_2^+ states of the A equals 42 nuclei are investigated with the use of known charge dependent effects and several model wave functions. In spite of a great success of the model having deformed state admixtures in the ^{42}Ca obtained by Flowers and Skouras, it is found that this model cannot account for the IMES with the use of the Coulomb interaction as an only charge dependent force. Employing a schematic model for the 0_1^+ and 0_2^+ states, qualitatively it is shown that the problem in the IMES of this model is resolved by the inclusion of the core polarization correction. Also, by a quantitative analysis of the difference between the 1f/sub $^7/_2$/ - 1d/sub $^5/_2$/$^{-1}$ energy gap obtained in the work of Flowers and Skouras and the experimental neutron energy gap, it is shown that the charge dependent s.p. energies of the proton 1f/sub $^7/_2$/ and 1d/sub $^5/_2$/ orbits are not the same, while the experimental Coulomb displacement energies of the ^{41}Sc - ^{41}Ca and the ^{39}Ca - ^{39}K are the same. The correction terms to the Coulomb IMES are evaluated, then rather good agreement with the experimental IMES is obtained. The possible phenomenological charge dependent nuclear forces are briefly discussed by comparing their effects with the remaining shifts. (auth)

8569 QUASI-FREF SCATTERING MODEL FOR NUCLEAR REACTIONS IN THE CONTINUUM. Mignerey, A. L. C. Rochester, NY; Univ. of Rochester (1975). 137p. University Microfilms Order No. 75-22,759.

Thesis (Ph. D.).

A general model approach has been applied to the nuclear equilibration process which permits calculation of preequilibrium decay spectra for any incident nuclear particle. The model assumes that the particle interacts with the target nucleons through successive two-body collisions, assuming a quasi-free scattering mechanism. The quasi-free scattering model calculations of (p,p'), (alpha, alpha') and (alpha,p) energy spectra are compared with experimental results. The majority of the (p,p') calculations were performed assuming a Fermi energy for the target nucleons corresponding to an average nuclear density. The results are in agreement with other preequilibrium models. The (alpha, alpha') calculations were performed for incident alpha energies from 35 to 90 MeV on targets ranging in mass from ^{51}V to ^{208}Pb. The Fermi energy of 8 MeV chosen for the calculations was the value which best reproduced the shape of the 55 MeV ^{208}Pb (alpha, alpha') experimental spectrum. An alpha breakup factor of 50 percent was required to normalize the calculated energy spectra to the experimental energy spectra. The Fermi energy of 8 MeV and alpha breakup factor of 50 percent were used for all (alpha, alpha') calculations unless otherwise indicated. The agreement with experiment was quite encouraging considering the large variation in target mass and incident alpha energy. If the nucleon distribution created in the (alpha, alpha') calculation is used as the initial nucleon distribution in a (p,p') calculation, an (alpha,p) energy spectrum is the result. The agreement of the calculated (alpha,p) spectra with experimental data is well within the uncertainties of the model for most cases. Preliminary applications of the model to (nucleon, alpha) and (^{12}C,alpha) reactions are also discussed, as well as the possibility of contributions from the (alpha,^{3}He) pickup reaction in the (alpha, alpha') experimental spectra. (Diss. Abstr. Int., B)

8570 CALCULATION OF THE AVERAGE NUMBER OF INTERACTING NUCLEONS AT HIGH ENERGY NUCLEUS COLLISIONS. Levkovskii, A. A.; Tupikov, N. S. pp 325-338 of Uskorenie Chastits i Yadernye Reaktsii v Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851--.

Using the optical model a calculation is made of the average number of interacting nuclei at the high energy nucleus collisions. It is shown that this effect is essentially strong at the interactions of the heavy nuclei with the light ones. At the collisions of the same nuclei the effect is of significant value at the interactions of the light nuclei with the heavy ones the effect is weak. (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 7376, 7939, 8268, 8270, 8274, 8298, and 8599.

8571 (AED-CONF-75-103-004) STRAY RADIATION NEAR A WATER PHANTOM DURING IRRADIATION WITH A LIGHT-STABILIZED X-RAY TUBE. Pott, F. P. (Technischer Ueberwachungs-Verein Rheinland e.V., Koeln (F. R. Germany)). 1975. 8p. (In German). INIS.

From symposium on practical experience with radiation protection control as specified in paragraph 4.1 of the x-ray ordinance; Braunschweig, F. R. Germany (15 Apr 1975).

7 figs.; 3 tabs. With abstract.

The measurements show that the 6 cm aluminium shield specified as an addition to the water phantom by the regulations for radiation protection control for radiation protection measurements on light-stabilized X-ray equipment may be substituted for with equivalent results by a 3.5 mm copper shield or a 5.5 mm iron shield. Comparative measurements, with a 30 cm water phantom and comparisons with stray radiation measurements on X-ray instruments with fluorescent screens (90 kV, 3 mA) show that additional absorber shields of only 4 cm aluminium or 2.5 mm copper or 3.5 mm iron are sufficient to provide a satisfactory control of the light-stabilized X-ray equipment. (GE)

8572 (EUR-5373e) ANGULAR GAMMA FLUX IN AN IRON SLAB SHIELD. Penkuhn, H. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1975. 20p. Dep. NTIS (US Sales Only) $4.50. EUR FB 70,-.

The angular distribution of the photon energy and dose rate flux in a plane iron shield is investigated assuming an isotropic volume source. Near the shield axis ($\cos\varphi \sim 1$, with φ = angle between shield axis and gamma direction) the angular spectrum is strongly space-dependent. For larger φ, space-independent fits are given. Source energies from 0.662 to 6 MeV and penetrations from 6 to 60 cm are treated, and the results are compared with a similar investigation on normal concrete. The differences in iron-concrete are appreciable only for the lowest source energy. (2 figs, 6 tables) (auth)

8573 (N--75-12883) ESTIMATES OF RADIATION EXPOSURE FROM SOLAR COSMIC RAYS IN SST ALTITUDES. Foelsche, T. (National Aeronautics and Space Administration, Langley Station, Va. (USA). Langley Research Center). Nov 1974. 14p. (NASA-TM-X--71990). NTIS $3.25.

Factors influencing crew and passenger exposure to solar and galactic cosmic rays that is expected to occur during flights of supersonic transport aircraft are discussed, and some possibilities are considered for decreasing such exposure. (auth)

8574 IZBRANNYE TRUDY. (Selected Works of A. I. Alikhanov). Alikhanov, A. I. Moscow; Izdatel'stvo Nauka (1975). 304p.

Selected works of Alikhanov are compiled. They deal with x-ray physics, interaction of γ quanta with matter, β decay, passage of charged particles through matter, elementary particle physics, and reactor physics and technology. The date of the publication of the articles range from 1933 to 1956. (JSR)

8575 CALCULATION AND MEASUREMENT OF TIME-OF-FLIGHT DISTRIBUTIONS OF MULTI-SCATTERED GAMMA RADIATION. Duerner, H. Frankfurt am Main; Univ. Frankfurt am Main (1972). 113p. (In German). INIS.

Thesis.

In the present paper, the time of dispersion of multiply scattered gamma radiation in a scattering medium similar to water with a density of rho = 0.52 g/cm^3 is dealt with. It is measured by the time-of-flight method with an arrangement of two fast scintillation detectors and calculated according to the Monte-Carlo method using the known materials parameters. The experiment gives energy-integral time distributions which are modified by the characteristics of the detector equipment. (GE)

8576 SMALL-ANGLE SCATTERING OF SWIFT ELECTRONS AND POSITRONS IN A CRYSTAL. Kudrin, V. V.; Vorobiev, S. A. (Tomsk Polytechnical Inst., USSR). Radiat. Eff.; 25: No. 2, 119-125(1975).

Features of small-angle scattering of charged particles by the crystal structure and two-dimensional angular distributions are studied on the basis of Monte-Carlo calculations of 20 MeV electron and positron transmission through a ⟨001⟩ MgO single crystal. An accurate method for calculation of the charged particle scattering in a heterogeneous electron gas in the crystal is proposed. The analytical conditions under which the string-effect influences the small-angle scattering are derived and comparison is carried out with well-known experimental data. (auth)

8577 ENERGY LOSS OF LOW-VELOCITY HEAVY IONS IN PLANAR CHANNELLING. Pathak, A. P. (CEN, Fontenay-aux-Roses, France). J. Phys., C (London); 8: No. 16, L341-L345 (21 Aug 1975).

The variation of electronic energy loss of low-velocity heavy ions in planar channelling is calculated as a function of the position of the ion in the channel. The model used is that applied recently to explain Z_1 and Z_2 variations in electronic stopping power, in which the heavy ion is assumed to lose energy by transferring momentum to the target electrons which scatter elastically from it. The results for 60 MeV ^{127}I ions in the {100} channel are compared with experimental results and with previous calculations based on Firsov's theory. (auth)

8578 CALCULATION OF ELECTRON DOSE DISTRIBUTION FOR RADIOTHERAPY TREATMENT PLANNING. Kawachi, K. (National Cancer Center, Tokyo). Phys. Med. Biol.; 20: No. 4, 571-577(Jul 1975).

It is difficult to obtain electron dose distributions in a phantom by calculation. The following formula was derived from the age diffusion equation for the purpose of computer treatment planning of electron therapy: $D(x,z,\tau) = A[\mathrm{erf}(X_0^* / 2(\kappa\tau)^{1/4}) + \mathrm{erf}(X_0^* / 2(\kappa\tau)^{1/4})] \cos[(2\pi/3R_e)\, z - (\pi/6)] \exp\{-[2\pi/3R_e(\kappa\tau)^{1/4}]^2\}$, where D is the electron dose, x is the distance from the central axis of the field, z is the depth in the phantom, A an arbitrary constant, $2X_0$ the width of the field on the surface, κ the diffusion coefficient of the medium, R_e the extrapolated electron range and τ is an "age" parameter which increases as the electron energy is degraded in the medium. This formula is able to generate a spatial electron dose distribution with good approximation to experimental values given only the incident electron energy and field size. (auth)

8579 COBALT-60 AXIAL PERCENTAGE DEPTH DOSES ARE CONSISTENT. Pfalzner, P. M. (Ontario Cancer Treatment and Research Foundation, Ottawa). Phys. Med. Biol.; 20: No. 4, 661-663(Jul 1975).

The Report of the Hospital Physicists' Association Working Party reviewing the 1961 Depth Dose Tables for Use in Radiotherapy (Supplement 10) comments on the quite large variations (up to 10 per cent) for new data for ^{60}Co depth doses at 100 cm for large depths, and the same comment is also made in a later publication. An inspection of the relevant results revealed that the observations concerning axial depth doses at 100 cm SSD were based on an erroneous comparison with Supplement 10 values for 80 cm SSD, and not 100 cm SSD. The correct comparison yields ^{60}Co axial depth dose values which deviate at most by −3.2% and +2.0%, and the self-consistency of these axial doses is quite satisfactory over the whole range of SSDs (50, 60, 80 and 100 cm). The supposed large discrepancy originated in the propagation of an error from one authority to another. (UK)

8580 FORMAL THEORY OF ELECTRONIC STOPPING OF CHANNELED IONS. Yussouff, M. (Indian Inst. of Tech., Kanpur). Solid State Commun.; 17: No. 2, 119-125(15 Jul 1975).

A formal theory is presented which accounts for the channel through its effect on ionic charge distribution. The effective ionic potential is found perturbationally, leading to formal expressions for the phase shifts and stopping power. A unified explanation of Z_1 and Z_2 oscillations follow and some interesting implications for the experiments are discussed. (auth)

8581 DOSE RATES FROM PLANE SOURCES OF GAMMA RAYS. Dickson, H. W.; Kerr, G. D. (Oak Ridge National Lab., TN). Health Phys.; 29: No. 1, 131-136(Jul 1975).

An integral expression was derived for calculating the dose rate from a rectangular source which can be reduced to sources having the form of either an infinite plane strip or an infinite plane. Consideration of dose buildup was made by incorporating a dose buildup factor of the Berger form in the equation. Results of calculations of the dose rate from an infinite strip source are presented as a fraction of that from an infinite plane source. The equation has been applied to strip sources varying from 1 to 1000 m in width and for γ energies ranging from 50 keV to 5 MeV. The application of the equation and data to the calculation of dose rates above a shore or beach surface contaminated by radionuclides released to the environment in liquid effluents from nuclear power stations or other nuclear facilities is discussed. (auth)

8582 TRANSFORMATION METHOD FOR THE MIRD ABSORBED FRACTION AS APPLIED TO VARIOUS PHYSIQUES.

Yamaguchi, H.; Kato, Y.; Shiragai, A. (National Inst. of Radiological Sciences, Chiba, Japan). Phys. Med. Biol.; 20: No. 4, 593-601(Jul 1975).

A transformation method was investigated for applying the MIRD absorbed fraction to internal dose calculations for an individual. The transformation method consists of two parts, transformation of the target organ mass, and of the distance between source and target organs. The variation of the specific absorbed fraction with distance in the human body was approximated with the traditional exponential form. To examine the transformation method, experiments were carried out for cobalt-60 gamma rays, using LiF-TLD, with the thyroid and ovaries as source organs. The transformed values of the MIRD absorbed fractions agreed well with the experimental values. Some results obtained from the MIRD values by these transformation methods were also compared with those for younger age groups calculated by Snyder. (auth)

8583 X-RAY ATTENUATION IN STEEL: 50 TO 300kVp. Trout, E. D.; Kelley, J. P.; Herbert, G. L. (Oregon State Univ., Corvallis). Health Phys.; 29: No. 1, 163-169(Jul 1975).

Using broad beam geometry, attenuation data for mild steel have been measured for x-ray tube potentials of 50 to 300 kVp using the total initial beam filtrations recommended in NCRP Report No. 34. Data are presented in the form of graphs and tables, consistent with the format of NCRP reports, to permit their use in designing medical, industrial and research installations. (auth)

8584 GRAPHIC RELATIONS BETWEEN keV: HVL, AND DEPTH DOSES IN THE SKIN FOR SOFT X-RAYS. van Caneghem, P. (Univ., Liege); Lipnik, P. Int. J. Appl. Radiat. Isot.; 26: No. 8, 455-458(Aug 1975). (In French)

Formulas and graphs are presented which show the relationship between the HVL in mm Al, the equivalent kilovoltage, the tissular HVL and the depth dose in the skin for soft x-rays (HVL: 0.01 to 3 mm Al or 4.5 to 34 keV), as sometimes used in superficial radiotherapy, in cutaneous radiography and in radiobiology. (auth)

8585 ELECTRON TRANSMISSION AT 10 TO 30 KeV. Lantto, V. (Oulu Univ., Finland). J. Phys., D. (London); 8: No. 11, 1341-1352(1 Aug 1975).

An equation is given for the total fraction of electrons transmitted through a metal film at normal incidence. Values of the angular distribution of the transmitted electrons are used in the equation. Both small-angle and large-angle scattering are thus included in the consideration of the transmission. The energy loss is taken into account by means of an equation for the average energy of the transmitted electrons. Transmission calculations have been carried out for 10, 20 and 30 keV electrons in copper and gold. The angular distributions have been taken from the Goudsmit-Saunderson multiple-scattering theory and from the statistical theory of Bethe. The calculated values of the transmission are larger than the experimental ones, except at very large film thicknesses. The main reason for this seems to be the neglect of high-angle electrons in the calculations. By using experimental energy distributions, it is possible to estimate the error arising from the average-energy approximation. (auth)

8586 CHERENKOV RADIATION BY A PARTICLE MOVING WITH A NON-UNIFORM VELOCITY. Sharma, S. R.; Swami, K. C. (Rajasthan Univ., Jaipur, India). J. Phys., A. (London); 8: No. 7, 1185-1188(Jul 1975).

Energy loss by a charged particle moving with non-uniform velocity in a uniform dielectric medium is investigated. Assuming constant deceleration, an expression is derived for radiation emitted in an arbitrary distance x, and the case of Cherenkov radiation is discussed in detail. Expressions are presented for energy radiated per unit frequency interval and for Cherenkov angle containing first-order terms in retardation. (auth)

8587 DEPTH-DOSE DISTRIBUTIONS IN AN ALUMINUM-BLUE-CELLOPHANE STACK FOR A HIGH-INTENSITY PULSED ELECTRON BEAM IN AN ATMOSPHERE OF HELIUM. Tanaka, R.; Sunaga, H.; Hotta, H. (Japan Atomic Energy Research Inst., Takasaki). Radiat. Res.; 63: No. 1, 14-23(Jul 1975).

The depth-dose curves of a high-intensity relativistic pulsed electron beam at various distances from a tube face in helium of various pressures were determined by using a stack of aluminum absorbers and blue cellophane sheets. The curves indicate that the beam is self-focused at two pressure regions, i.e., near 10 torr and above 600 torr, and that the beam is defocused considerably between these two pinches. The extrapolated ranges decreased rapidly with distance from the tube face at 0.01, 50 and 655 torr but not at 10 torr. This decrease is explained in terms of some beam-plasma interactions--especially in terms of an induced backward electric field and weak focusing of lower-energy electrons. 10 figs. (auth)

8588 DEPENDENCE OF SELF-FOCUSING OF A HIGH-INTENSITY PULSED ELECTRON BEAM ON GASEOUS MEDIA AS STUDIED BY DEPTH-DOSE DISTRIBUTIONS. I. Hydrogen and Monatomic Gases. Hotta, H.; Tanaka, R.; Sunaga, H.; Arai, H. (Japan Atomic Energy Research Inst., Takasaki). Radiat. Res.; 63: No. 1, 24-31(Jul 1975).

The depth-dose curves in a stack of aluminum absorbers and blue cellophane sheets were determined for a pulsed electron beam that emerged from a Febetron 706 and passed through H_2, D_2, He, Ne, Ar, Kr, and Xe at various pressures. The curves indicate that the beam is self-focused in two pressure regions, i.e., below 15 torr and above 20 torr. Results in the first region enable us to determine the relative total ionization cross sections of the gases; they were obtained from the gas pressure at which the beam was self-focused to a fixed degree. The pinch of the beam above 20 torr can be explained in terms of the recombination processes of secondary electrons with positive ions. The recombination coefficients in monatomic gases are discussed in support of our point of view. The pinch declines again at high pressures as a consequence of the competition between self-focusing and multiple scattering. (6 figs, 14 refs) (auth)

8589 DEPENDENCE OF SELF-FOCUSING OF A HIGH-INTENSITY PULSED ELECTRON BEAM ON GASEOUS MEDIA AS STUDIED BY DEPTH-DOSE DISTRIBUTIONS. II. Inorganic Polyatomic Gases. Hotta, H.; Tanaka, R.; Arai, H. (Japan Atomic Energy Research Inst., Takasaki). Radiat. Res.; 63: No. 1, 32-41(Jul 1975).

The work on the self-focusing of a pulsed electron beam as studied by depth-dose distributions has now been extended to N_2, O_2, N_2O, CO_2, and SF_6. The depth-dose curves in the dosimeter in an atmosphere of these gases below 10 torr enable us to determine the relative total ionization cross sections. In order to test the pinch of the beam above 10 torr, we estimated the rate of the recombination of secondary electrons with positive ions from momentum-transfer cross sections as a function of mean electron energy. Recombination times thus calculated in consideration of thermalization times are consistent with the kinetic scheme for explaining the self-focusing. The multiple scattering of the primary beam above 150 torr is discussed as functions of anti Z (anti Z + 1)M/anti A. (7 figs. 17 refs.) (auth)

8590 ENERGY STRAGGLING PARAMETERS FROM SINGLE EVENT SPECTRA. Wilson, W. E.; Toburen, L. H.; Glass, W. A. (Battelle Pacific Northwest Labs., Richland, WA). Radiat. Res.; 63: No. 3, 387-394(Sep 1975).

The variance of an energy straggling distribution for thin absorbers is determined by the cross section for energy loss in single collisions. The ratio, $delta_2$, of this variance and the mean energy loss is independent of the thickness of the absorber; it is also numerically equal to the quotient of the second by the first moment of the single collision spectra. Measured doubly differential cross sections for electron emission by energetic charged particles from low-Z molecular targets provide a major part of the primary data required for calculating $delta_2$. The relationship between $delta_2$ and experimentally measurable cross sections for single collision energy loss is developed. Values of $delta_2$ calculated from measured single collision cross sections are compared with values obtained from the free electron model and experiment. (auth)

8591 COMMENTS ON FANO'S THEOREM. Spencer, L. V. (National Bureau of Standards, Washington, DC). Radiat. Res.; 63: No. 1, 191-199(Jul 1975).

Fano's proof that uniform radiation fields result when sources and interactions are strictly proportional to local density is discussed in connection with an alternative proof formulation. (15 refs.) (auth)

8592 FEASIBILITY OF COHERENT X-RAY PRODUCTION BY X-RAY PUMPING. Csonka, P. L.; Crasemann, B. (Univ. of Oregon, Eugene). Phys. Rev., A; 12: No. 2, 611-614(Aug 1975).

It is suggested that coherent soft x rays can be produced by inverting the electron population in a suitable target, such as Li, through irradiation with x rays generated by fast electrons traversing an electromagnetic field (as in a storage ring). Conditions to be satisfied by target and radiation parameters are stated, and examples given. (auth)

Radiation Protection Standards

8593 DIAGNOSTIC X-RAY SURVEY PROCEDURES FOR FLUOROSCOPIC INSTALLATIONS. Hendee, W. R.; Chaney, E. L. (Colorado Univ., Denver). Health Phys.; 29: No. 2, 331-337(Aug 1975).

Although calibrations and radiation protection surveys of diagnostic x-ray equipment are the responsibility of many medical and health physicists, written protocols for these surveys have

not been developed. As a consequence, procedures differ among surveyors concerning what is measured and how it is measured, and results among different x-ray units often can be neither correlated nor compared. As guidelines to resolve this difficulty, a series of papers is planned on diagnostic x-ray survey procedures. This paper is the first in the series and is directed to survey procedures for undertable fluoroscopic installations. (auth)

8594 TECHNICAL EQUIPMENT AND METHODIC SINGULARITIES OF RADIOTHERAPY BY BEAMS OF HIGH-ENERGY HEAVY CHARGED PARTICLES. Vorob'ev, E. I.; Tikhonov, K. B.; Volkov, A. A.; Sinitsyn, R. V.; Voronin, Yu. V.; Konnov, B. A. pp 300-305 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The engineering-physical and methodical problems which must be solved in order to make radiotherapy with high-energy heavy charged particles both economical and practical as well as safe are outlined. The work being done to solve these problems is briefly discussed. (JSR)

8595 DEVELOPMENT AND INVESTIGATION OF THE BASIC PHYSICOTECHNICAL CHARACTERISTICS OF DOMESTIC γ THERAPEUTIC APPARATUS. Belotserkovskii, S. E.; Bibergal, A. V.; Zhukovskii, E. A.; Kondrashov, V. M.; Nikulin, Yu. P.; Ratner, T. G.; Sul'kin, A. G. pp 403-409 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The effects of various factors on the displacement of the dose maximum with respect to the coordinates of the location of the irradiated site was studied for rotational, pendulum, tangential, and convergent methods of irradiation. Expressions were derived for the displacement of the center of dose maximum for each of these types of irradiation. The mean square error of displacement was evaluated. (JSR)

8596 DEVELOPMENT AND INTRODUCTION OF γ THERAPEUTIC APPARATUS ACCORDING TO THE STANDARD CLASSIFICATION SERIES OF THE CMEA (COUNCIL FOR MUTUAL ECONOMIC AID). Sul'kin, A. G.; Shtan, A. S.; Bibergal, A. V.; Gordon, V. I.; Kondrashov, V. M.; Bol'shakov, E. F.; Emel'yanov, V. T.; Zhukovskii, E. A.; Nikeshichev, V. N.; Petrov, G. G.; Rimman, A. F. pp 409-415 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The CMEA adopted a universal series of γ therapy devices consisting of the following basic types: stationary long-distance, rotational long-distance, rotational-convergent long-distance, and short-distance. The development in the USSR of devices of each of these types according to the standards adopted by the CMEA is discussed, and the principal characteristics of each type is summarized. (JSR)

8597 DEVELOPMENT AND INVESTIGATION OF THE γ THERAPY APPARATUS GUT-Co-1200 AND RAD-1. Kondrashov, V. M.; Sul'kin, A. G.; Kodyukov, V. M.; Bal'sevich, S. Ya.; Zhukovskii, E. A.; Emel'yanov, V. T.; Petrov, G. G.; Galina, L. S.; Garbuzov, M. I. pp 415-422 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The principal characteristics of the GUT Co-1200, developed from improvements made to the standard GUT Co-400, are briefly summarized. The scheme for the placement of the irradiation head and typical isodose curves obtained with it are shown. A new irradiation table to be used with this device is briefly described. The basic characteristics of the RAD-1, which also uses a ^{60}Co source, are outlined. This device was designed for rotational, pendulum, stationary, and tangential irradiations. (JSR)

8598 FORMING THE DOSE FIELD IN SHORT-DISTANCE γ THERAPY. Galina, L. S.; Vainberg, M. Sh.; Vasil'eva, E. Yu.; Guslits, V. M.; Zhukovskii, E. A.; Kodyukov, V. M.; Rimman, A. F.; Sul'kin, A. G. pp 437-443 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The dose field in the RIST, a γ therapy device with ^{137}Cs that can be used for stationary or mobile irradiations, is formed by movable W alloy inserts and movable tube localizers. The characteristics of the dose field in stationary and mobile irradiations are tabulated. The characteristics of the dose field obtained with the RIST are compared with that of other irradiation devices. (JSR)

Radiation Source Calibration and Standardization

Refer also to abstract 7258.

8599 STANDARD SOURCES FOR HEALTH PHYSICS INSTRUMENT CALIBRATION. Kathren, R. L. (Portland General Electric Co., OR). Health Phys.; 29: No. 1, 143-153(Jul 1975).

A basic review of radioactive and machine sources of ionizing radiation useful for health physics instrument calibration, with particular emphasis on the needs of the applied health physicist. Topics considered include standards terminology and hierarchy; α, β, electromagnetic and neutron sources; and accuracy limits under laboratory and field conditions. Detailed characteristics of common sources and their salient physical characteristics are tabulated. (auth)

8600 STANDARDIZATION OF MEGAVOLT BEAMS OF MEDICAL INSTALLATIONS FOR DISTANCE RADIOTHERAPY. Ermakov, I. A.; Sinitsyn, R. V. pp 174-177 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The studies made on the standardization of bremsstrahlung, ^{60}Co, and fast electron beams used for therapeutic purposes are outlined. The experimental conditions for the measurement of the absorbed dose with ionization chambers and calorimetric installations were described. (JSR)

8601 SIMULATION OF THE DOSE FIELD BY MEANS OF AN OPTICAL WEDGE DURING MULTIFIELD IRRADIATION. Denisenko, O. N.; Il'ichev, B. V.; Kozlov, V. A. pp 181-185 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

A method is proposed for the optical simulation of the dose field in multifield irradiation. The basic characteristic of the method is that for each optical model of the dose field its own light source is used. The preparation of the field models and the method for obtaining the total isodose picture during multifield irradiation are described. (JSR)

8602 EXPERIMENT ON THE ORGANIZATION OF DOSIMETRY IN MEGAVOLT RADIATION INSTALLATIONS. Gumanskii, G. A.; Volmyanskii, E. I.; Tarutin, I. G.; Lyutsko, A. M.; Gubskii, I. A.; Ivanov, G. I. pp 188-191 of Radiatsionnaya Meditsina. Berkgaut, V. G. (ed.). Moscow; Atomizdat (1972). (In Russian)

From 20th conference of production and use of isotopes and nuclear radiation sources in the national economy conference; Minsk, USSR (Oct 1968). See CONF-681061-P3.

The coupling factor between the absorbed dose and exposure dose was measured at electron energies from 5 to 40 MeV. The results showed that with increase of electron energy the coupling factor decreased. The neutron dose during use of accelerator bremsstrahlung was determined. The results showed that for exposure doses of bremsstrahlung of 10,000 R the contribution of the neutron component to the total dose did not exceed 0.33% of the dose absorbed in the tumor. The induced activity arising during use of the LUE-25 linear electron accelerator was also studied. (JSR)

8603 RESULTS OF THE 1972 CAP/NBS STUDY OF RADIONUCLIDE MEASUREMENTS. Hauser, W. (McGill Univ., Montreal). Am. J. Clin. Pathol.; 63: No. 4, 545-548(Apr 1975).

In 1972 a pilot study was carried out to evaluate radioactivity assay procedures for in-vivo administration in nuclear medicine. The plan was to determine the accuracy with which a measured quantity of radioactivity can be administered to a patient. Delivered samples were returned to the National Bureau of Standards by 33 participants. The activity values of 47 percent of the participants were within +-10 percent and 81 percent were within +-20 percent of the activity value of the samples subsequently measured by the National Bureau of Standards. The analysis of the variability indicated that many of the difficulties encoun-

tered by the participants were due to two factors outside their control: differences in assay values of chromium-51 between radiopharmaceutical companies and poor calibration or instruction by the manufacturers of dose calibrators. (auth)

Shielding Calculations and Experiments

Refer also to abstract 8572.

8604 SIMPLE APPROACH TO CALCULATING GAMMA RAY SKYSHINE FOR REDUCED SHIELDING APPLICATIONS. Borak, T. B. (Argonne National Lab., IL). Health Phys.; 29: No. 3, 423-425(Sep 1975).

Gamma irradiation facilities are being designed with the minimum radiation shielding. In particular this applies to the roof, thus increasing the amount of radiation escaping skyward and atmospherically reflected toward neighboring facilities. A simplified single scatter treatment which yields a first order approximation to the amount of γ ray SKYSHINE is presented here. The pessimistic case with only a forward shielding wall reduces to a single summation which can be readily performed on a desk calculator. (UK)

PHYSICS (THEORETICAL)

General

Refer also to abstracts 8166, 8644, and 8652.

8605 (COO-2271-60) EXAMPLES OF FOUR-DIMENSIONAL SOLITON SOLUTIONS AND ABNORMAL NUCLEAR STATES. Lee, T. D. (Columbia Univ., New York (USA); European Organization for Nuclear Research, Geneva (Switzerland)). 1975. 8p. (CONF-750695-3). Dep. NTIS $4.50.

From conference on extended systems in field theory; Paris, France (26 Jun 1975).

The classical soliton solution is defined to be one that (1) has finite and nonzero rest mass, and (2) is contained in a finite region in space. Starting with a relativistic boson field with nonlinear coupling, four dimensional quantum soliton solutions are discussed by considering the classical solution and then quantizing it by a general canonical procedure. Remarks are then given on the generalization of the soliton mechanism to include fermions, leading to abnormal nuclear states. (SDF)

8606 (DESY-L-Ueb-203) QUANTIZATION OF SOLITONS. Korvpin, V. E.; Kulish, P. P.; Faddeev, L. D. Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 21: No. 5, 302-305(Mar 1975). 5p. (In German). INIS.

The quasi-classical quantization of particle-like solutions is discussed by the example of the "sine-Gordon" equation, and quanta corrections are calculated using a functional integration. (GE)

8607 (ORO-4856-21) CONSTRAINTS IN QUANTUM MECHANICS VIA LAGRANGIANS, HAMILTONIANS, AND CANONICAL EQUATIONS OF MOTION. Amiot, P.; Griffin, J. J. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). [nd]. 24p. Dep. NTIS $4.50.

A general method of derivation of the auxiliary constrained Hamiltonian describing a constrained system is proposed. The introduction of the constraint operator into the Lagrangian leads, for holonomic constraints, to a simple definition of the auxiliary Hamiltonian by a unitary transformation on the unconstrained Hamiltonian. This gives immediately the constrained parametrized wave function once the unconstrained one is known. This method which gives results different from other methods, is designed to calculate collective kinetic energy terms of the Hamiltonian describing collective motions of N-body systems, but offers, in addition, the promise of further development towards a complete, general theory of collective motion. (auth)

8608 ARE BELL'S INEQUALITIES CONCERNING HIDDEN VARIABLES REALLY CONCLUSIVE. Flato, M. (Univ., Geneva); Piron, C.; Grea, J.; Sternheimer, D.; Vigier, J. P. Helv. Phys. Acta; 48: No. 2, 219-225(25 Aug 1975).

It was remarked that the class of local hidden theories, introduced by J. S. Bell, lacks a certain desired stability property. One then draws some conclusions from this type of unstability and on that basis discusses the present experimental situation. (auth)

8609 NONLINEAR CANONICAL TRANSFORMATIONS AND THEIR REPRESENTATIONS IN QUANTUM MECHANICS. Mello, P. A.; Moshinsky, M. (Universidad de Mexico, Mexico City). J. Math. Phys. (N. Y.); 16: No. 10, 2017-2028(Oct 1975).

In the last few years an extensive literature has developed on linear canonical transformations and their representation in quantum mechanics. Applications of these results were made to clustering theory in nuclei, problems of accidental degeneracy, etc. In the present paper attention is turned to nonlinear canonical transformations. By dealing with appropriate functions f/sub a/(a equals 1,...,2n) of x/sub i/, p/sub i/(i equals 1,...,n) rather than with these variables themselves, one can in principle set unambiguously the equations that determine the representation in quantum mechanics of the canonical transformation under study. This result holds when the old and new functions f/sub a/ have the same spectrum. Specific examples are discussed when this last condition is satisfied: nonlinear canonical transformations in the radial variable that were obtained from projection of linear ones in higher-dimensional spaces; canonical transformations that go from one Hamiltonian to another with the same spectrum, be this one continuous or discrete; canonical transformations that relate two sets of integrals of motion (which include the Hamiltonians) when phase spaces of dimensions higher than 2 are involved, etc. In the concluding section, the possibility of extending the analysis to canonical transformations that do not conserve the spectrum of the relevant operators is briefly discussed. (1 figure) (auth)

8610 EXACT QUANTIZATION OF THE NONLINEAR SCHROEDINGER EQUATION. Kaup, D. J. (Clarkson Coll. of Tech., Potsdam, NY). J. Math. Phys. (N. Y.); 16: No. 10, 2036-2041(Oct 1975).

By means of an "inverse scattering transform," the one-dimensional nonlinear Schroedinger equation i Dirac constant PSI/sub t/ equals −(Dirac constant^2/2m)PSI/sub xx/−epsilon^2(PSI*PSI)PSI can be exactly quantized for any value of epsilon^2 equals real. When epsilon^2 is less than 0, the eigenvalues of the number operator, field momentum operator, and Hamiltonian are found to be exactly the same as the linear case. In other words, by quantizing the exact theory, no effects corresponding to "renormalization" are found, and the zero-point energy is independent of epsilon^2. When epsilon^2 less than 0, the Hamiltonian is unbounded from below, and, in addition to the above spectra of eigenvalues, bound states can occur. Each bound state can be interpreted to be a bound state of n "excitations," moving in a coherent fashion and with a binding energy proportional to the cube of the number of excitations. This problem is also formally equivalent to the N-body problem with a delta-function interaction solved by Bethe, with which these results are contrasted. In conclusion, ordinary field quantization versus "scattering space" quantization is discussed. (auth)

8611 NEW CLASS OF EXACT SOLUTIONS OF THE DIRAC EQUATION. Felber, F. S.; Marburger, J. H. (Univ. of California, Los Angeles). J. Math. Phys. (N. Y.); 16: No. 10, 2089-2092 (Oct 1975).

A new class of exact solutions of the Dirac equation with external electromagnetic fields is derived by assuming a set of field-dependent solution matrices which obey an algebra isomorphic to the Pauli matrices. The method of exact solution may be applied to any field having a four-vector potential, A/sup mu/, depending only on k/sup mu/x/sub mu/, but for which the field tensor and initial electron momentum are such that A/sup mu/A/sub mu/, A/sup mu/P/sub mu/, (sigma/sup mu nu/sub mu nu/)^2, and (sigma/sup mu nu/F'/sub mu nu/)^2 are independent of k/sup mu/x/sub mu/. Exact solutions for a circularly polarized propagating electromagnetic wave in an isotropic medium, for a screw-symmetric static magnetic field, and for a rotating uniform electric field are given in terms of the roots of a quartic equation. A class of solutions is given explicitly in the weak-field limit to lowest order in eA/mc^2. The vacuum limit of the solution of a wave propagating in a medium is shown to be the Volkov solution. (auth)

8612 HAMILTONIANS OF THE SCHROEDINGER ALGEBRA. Burdet, G.; Perrin, M. (CNRS, Marseille). J. Math. Phys. (N. Y.); 16: No. 10, 2172-2176(Oct 1975).

A complete characterization of the one-dimensional nonconjugate subalgebras of the extended Schroedinger algebra (and of the Schroedinger algebra) is given. This yields a classification into conjugacy classes of all the Hamiltonians admitting the extended Schroedinger algebra as time-dependent invariance algebra in the Schroedinger picture. The action of the inner automorphism induced by the general element of the extended Schroedinger algebra is determined, from which the explicit time dependence of the generators is deduced, whatever Hamiltonian is considered. (2 tables) (auth)

8613 FIXED PAST AND UNCERTAIN FUTURE: A SINGLE-TIME COVARIANT QUANTUM PARTICLE MECHANICS. Noyes, H. P. (Stanford Univ., CA). Found. Phys.; 5: No. 1, 37-43(Mar 1975).

A covariant quantum mechanics for systems of finite-mass particles at finite energy follows from interpreting as Wick–Yukawa fluctuations in particle number the quantum fluctuations which are needed by Phipps to understand measurement theory and by Gyftopoulos to understand the second law of thermodynamics. The dynamical one-variable equations require as input the (N–1)-particle transition matrices and an N–N vertex or coupling constants at three-particle vertices. (auth)

8614 VARIATIONAL METHOD AND NONLINEAR OSCILLATIONS AND WAVES. Hsieh, D. Y. (Brown Univ., Providence). J. Math. Phys. (N. Y.); 16: No. 8, 1630-1636(Aug 1975).

A direct variational method is developed for studying the asymptotic behavior of a wide class of nonlinear oscillation and wave problems. From some judiciously chosen trial solutions with adjustable parameters, equations governing the change of amplitudes and phases are derived and solved. The method is simple in concept and straightforward in application. Different aspects of the method are illustrated by applications to various examples: the oscillation of a pendulum with changing length; the motion of a

charged particle in a strong magnetic field; the linear and nonlinear Klein-Gordon equations; and the linear and nonlinear Korteweg-de Vries equations. (auth)

8615 REALIZATIONS OF THE CENTRAL EXTENSION OF THE INHOMOGENEOUS SYMPLECTIC ALGEBRA AS TIME DEPENDENT INVARIANCE ALGEBRAS OF NONRELATIVISTIC QUANTUM SYSTEMS. Burdet, G.; Perrin, M. (Centre National de la Recherche Scientifique, Marselle). J. Math. Phys. (N. Y.); 16: No. 8, 1692–1703(Aug 1975).

The one-element central extension of the Lie algebra of the group of real inhomogeneous linear canonical transformations of phase space is interpreted as a time-dependent invariance algebra in the Schroedinger picture. By limiting to a two-dimensional space quantum system one can exhibit all the nonconjugate Hamiltonians contained in the symplectic algebra which, in the Heisenberg picture, plays the role of dynamical algebra and contains several known degeneracy and spectrum-generating algebras. (3 figures, 2 tables) (auth)

8616 CONTRACTIONS OF SPACE–TIME GROUPS AND RELATIVISTIC QUANTUM MECHANICS. Huddleston, P. L.; Lorente, M.; Roman, P. (Boston Univ.). Found. Phys.; 5: No. 1, 75-87(Mar 1975).

The relation of the conformal group to various earlier proposed relativistic quantum mechanical dynamical groups (and other related groups) is studied in the framework of projective geometry, by explicitly constructing the contractions of the six-dimensional coordinate transformations. Five-dimensional realizations are then derived. An attempt is made to improve the physical insight through geometry. (auth)

8617 INTUITIVE UNDERSTANDING OF NONLOCALITY AS IMPLIED BY QUANTUM THEORY. Bohm, D. G.; Hiley, B. J. (London Univ.). Found. Phys.; 5: No. 1, 93-109(Mar 1975).

The fact is brought out that the essential new quality implied by the quantum theory is nonlocality; i.e., that a system cannot be analyzed into parts whose basic properties do not depend on the state of the whole system. This is done in terms of the causal interpretation of the quantum theory, proposed by one of us (D.B.) in 2952, involving the introduction of the "quantum potential." It is shown that this approach implies a new universal type of description, in which the standard or canonical form is always supersystem-system-subsystem; and this leads to the radically new notion of unbroken wholeness of the entire universe. Finally, some of the implications of extending these notions to the relativity domain, and in so doing, a novel concept of time, in terms of which relativity and quantum theory may eventually be brought together, is indicated. (auth)

8618 QUANTUM ACTION PRINCIPLE IN CURVED SPACE. Kawai, T. (Osaka City Univ.). Found. Phys.; 5: No. 1, 143-158 (Mar 1975).

Schwinger's action principle is formulated for the quantum system which corresponds to the classical system described by the Lagrangian L/sub c/(x,x) equals (M/2)g/sub ij(x)x/sup i/x/sup j/ − v(x). It is sufficient for the purpose of deriving the laws of quantum mechanics to consider only c-number variations of coordinates and time. The Euler–Lagrange equation, the canonical commutation relations, and the canonical equations of motion are derived from this principle in a consistent manner. Further, it is shown that an arbitrary point transformation leaves the forms of the fundamental equations invariant. The judicious choice of the quantal Lagrangian is essential in the formulation. A quantum mechanical analog of Noether's theorem, which relates the invariance of the quantal action with a conservation law, is established. The ambiguities in the quantal Lagrangian are also discussed, and it is pointed out that the requirement of invariance is not sufficient to determine uniquely the quantal Lagrangian and the Hamiltonian. (auth)

8619 IDENTIFICATION OF A PREFERRED INERTIAL FRAME. Gordon, C. N. (General Research Corp., Santa Barbara, CA). Found. Phys.; 5: No. 1, 173-183(Mar 1975).

The principle of relativity, that there is no preferred state of uniform motion, has recently come into conflict with certain cosmological observations. In an attempt to overcome this difficulty, an alternative formulation is explored in which this principle is replaced by the principle of universal time, while retaining the invariance of the speeds of light. These two postulates lead to a well defined world model in which one inertial frame has a preferred status. But the invariance properties of the laws of physics are unaffected, and the model may be regarded as a modified form of special relativity which is in accordance with the new cosmological evidence. (auth)

8620 NEW LOOK AT THE TRANSITION OF CLASSICAL TO QUANTUM MECHANICS. Gruber, G. R. (Hofstra Univ., Hempstead, NY). Found. Phys.; 5: No. 1, 59-61(Mar 1975).

In a recent "Rejoinder" by Landau, he indicates that there is an error in a previous article. In fact, this was corrected in an immediately subsequent article, and the "intriguing problem" to which Landau refers is solved in this subsequent article. These and other ideas on the subject are consolidated. In particular, it is shown that by discussing generalized coordinates in quantum mechanics one achieves much new insight, both philosophical and physical, in understanding the transition of classical to quantum mechanics. (auth)

8621 QUANTUM MECHANICAL TREATMENT OF DISSIPATIVE SYSTEMS. Hasse, R. W. (Univ., Munich). J. Math. Phys. (N. Y.); 16: No. 10, 2005-2011(Oct 1975).

Two types of Hamiltonians are investigated which describe quantum mechanically a particle moving subject to a linear viscous force under the influence of a conservative force: the conventional explicitly time-dependent one and an alternative class of nonlinear Hamiltonians. In the latter group a new form is proposed. By Ehrenfest's theorem the expectation values of the operators of physical observables correspond to the classical quantities. For all Schroedinger equations wavepacket, wave, stationary, and pseudostationary solutions of force-free motion, free fall, and harmonic oscillator are derived and discussed. (1 figure) (auth)

8622 CODE OF PRACTICE FOR THE DETAILED STATEMENT OF ACCURACY. Campion, P. J.; Burns, J. E.; Williams, A. London; Her Majesty's Stationery Office (1973). 56p.

No measurement can ever be exact, and it is important to know how accurate it is likely to be. This booklet discusses the assessment and derivation of numerical expressions describing the uncertainty of a measurement and its separation into random and systematic categories. Recommendations are put forward about how this uncertainty should be stated in an unambiguous way. A comprehensive statement of uncertainty is clearly necessary when reporting measurements of the highest order of accuracy, nevertheless, the general principles can be applied at all levels. (3 figures, 3 tables) (RWR)

8623 FOLDY–WOUTHUYSEN TRANSFORMATION FOR EQUATIONS CONNECTED WITH DE SITTER GROUP. Loide, R. K. R. (Tallin Polytechnical Inst.). Teor. Mat. Fiz.; 23: No. 1, 42-50(Apr 1975). (In Russian)

A Foldy–Wouthuysen transformation for the equations connected with the De Sitter group SO (1.4) is considered. The general transformation contains the usual Foldy–Wouthuysen transformation and the Cini–Touschek transformation. It is shown that the usual Foldy–Wouthuysen transformation is equivalent to the Lorentz transformation only for the edge weight points with $h = \pm n_1$ of the De Sitter group representation (n_1,n_2). An equation in the Cini–Touschek representation is for $h = \pm n$ equivalent to equations for the zero rest mass particles. From the known equations a connection between the Foldy–Wouthuysen and Lorentz transformations exists for the Dirac, Kemmer–Duffin and Bargmann–Wigner equations. For the Rarita–Schwinger equation in the SO(1,4)-form there is no equivalence. (auth)

8624 SCHROEDINGER EQUATION IN HELICAL COORDINATES. Garavaglia, T.; Gomatam, J. (Inst. of Higher Research, Dublin). Teor. Mat. Fiz.; 23: No. 1, 69-77(Apr 1975). (In Russian)

Orthogonal coordinate systems with helical geometry are constructed in euclidean three–dimensional space and the Schroedinger equations in these coordinate systems are obtained. Of the two helical coordinate systems discussed, the external system consists of flat surfaces while the internal system consists of surfaces of constant Gaussian curvature. A singular cylinder separates these two systems. (auth)

8625 IDENTIFICATION AND INTERPRETATION OF VARIABLES IN THE DIRAC THEORY OF SPIN-½ PARTICLES. Osche, G. R. Brooklyn; Polytechnic Inst. of Brooklyn (1975). 160p. University Microfilms Order No. 75-21,392.

Thesis (Ph. D.).

An interpretive study of the Dirac theory in the Foldy–Wouthuysen representation is presented. Several well known position and spin variables are investigated as to their ability to produce classically acceptable force and torque expressions in the correspondence limit. In addition, the Dirac and Dirac-Pauli equations are transformed to the Foldy-Wouthuysen representation in such a manner as to be more amenable to interpretation. In particular, it is shown that the original Dirac position operator and the Pryce position operator "c" yield force expressions for the force on a classical magnetic dipole. On the other hand, it is the Foldy-Wouthuysen mean spin which yields classically acceptable torque expressions. Since these operators do not constitute a pair of variables in the sense of maintaining the total angular momentum commutation rules, the dilemma arises as to the construction of

a pair of variables which can simultaneously satisfy both requirements. An interpretive solution is suggested, which is in agreement with current ideas in the literature, whereby more than one pair of variables may have meaning within the Dirac theory. (Diss. Abstr. Int., B)

8626 APPROXIMATE CYLINDRICALLY SYMMETRIC STATIONARY SOLUTION OF THE EINSTEIN–MAXWELL EQUATIONS WITH QUASI-NEUTRAL DUST SOURCES. da Teixeira, A. F.; Som, M. M. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Rev. Bras. Fis.; 4: 101-106(May 1974).

An approximate solution is presented for the Einstein–Maxwell equations for cylindrically symmetric fields whose distribution consists of two clusters of oppositely charged particles traveling in circles in opposite directions so that the net angular momentum is zero and the entire system is electrically neutral. For a specific azimuthal current and a quasi-neutral dust source, the approximate solution corresponds to a distribution of weakly charged particles in a limited region around the axis of symmetry. (IAA)

Quantum Field Theories

8627 (CONF-750975-3) PROBLEMS OF QUANTUM ELECTRODYNAMICS IN HEAVY-ION COLLISIONS. Mueller, B. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 15p. Dep. NTIS $4.50.

From 4th international conference on beam-foil spectroscopy; Gatlinburg, Tennessee, USA (15 Sep 1975).

The use of heavy ion reactions in studying basic problems of very strongly bound particles is discussed. Specifically, the fusion of two heavy nuclei, e.g., u + u, to form a superheavy quasimolecule is considered theoretically, with suggestions given for possible experiments. (12 figures) (SDF)

8628 (COO-2271-62) QUANTUM EXPANSION OF SOLITON SOLUTIONS. Christ, N. H. (Columbia Univ., New York (USA)). 1975. 12p. (CONF-750695-2). Dep. NTIS $4.50.

From conference on extended systems in field theory; Paris, France (26 Jun 1975).

A method for giving quantum mechanical meaning to particle-like (soliton) classical solutions is described in an attempt to relate particle-like solutions of classical nonlinear field theory to physical hadrons. The method uses the familiar canonical Hilbert space formalism of quantum mechanics and has been applied to the quantum mechanical interpretation of both static and time-dependent classical soliton solutions. (SDF)

8629 CALCULATION OF CALLAN–SYMANZIK EQUATION PARAMETERS USING DIMENSIONAL REGULARIZATION. Caswell, W. E. Princeton, NJ; Princeton Univ. (1975). 93p. University Microfilms Order No. 75-23,186.

Thesis (Ph.D.).

Techniques are developed for calculating the renormalization group parameters in two-loop order for renormalizable quantum field theories. Dimensional regularization provides an effective framework for calculating, particularly in gauge theories. It may be naturally used to define a "soft" renormalization procedure, which has a good zero-mass limit. The Green's functions then satisfy the "new" Callan-Symanzik equations with coefficients easily calculable from the pole counter-terms of the Lagrangian. The coefficients have the simplest gauge dependence possible for covariant gauges. Several theories in two-loop order were studied, in particular JBW QED and non-Abelian gauge theories, for which the renormalization-group analysis is adequate to study the large-momentum behavior of the Green's functions. Some remarks are made on the experimental predictions of NAGT that depend on two-loop results. (Diss. Abstr. Int., B)

8630 PULSE WIDTHS AND TIME DILATATION. Newburgh, R. G. (Air Force Cambridge Research Labs., Bedford, MA). Found. Phys.; 5: No. 3, 399-405(Sep 1975).

The temporal widths of a light pulse as measured in different inertial frames are shown to have a relation more complicated than that of a simple time dilatation. The result is compared with the dilatation in the twin paradox Gedanken experiment. The light pulse measurement requires two observers in two different frames. The measurements of the observers are compared. For the twin experiment a comparison is made between two clocks which have undergone different histories between the two points at which their world lines intersect. (auth)

8631 TWO-PARTICLE COLLISION IN AESTHETIC FIELD THEORY. Muraskin, M.; Ring, B. (Stanford Univ., CA). Found. Phys.; 5: No. 3, 513-523(Sep 1975).

A new computer solution was found to the aesthetic field equations. This solution describes a two-particle system with more structure than previously found. The contour lines show an arm structure. Four arms were observed around the maximum center. The location of the maximum (minimum) center is not along a straight line as a function of time. This is the first time that such an effect was observed for any kind of nonlinear partial differential equation, so far as is known. A further discussion of the aesthetic principles leading to the field equations is given. (auth)

8632 CONSEQUENCES OF THE INERTIAL EQUIVALENCE OF ENERGY. Davidon, W. C. (Haverford Coll., PA). Found. Phys.; 5: No. 3, 525-542(Sep 1975).

The usual macroscopic theory of relativistic mechanics and electromagnetism is formulated so that all assumptions but one are consistent with both special relativity and Newtonian mechanics, the distinguishing assumption being that to any energy E, whatever its form, there corresponds an inertial mass E/c^2. The speed of light enters this formulation only as a consequence of the inertial equivalent of energy $1/C^2$. While, for $1/C^2$ greater than 0 the resulting theory has symmetry under the Poincare group, including Lorentz transformations, all its physical consequences can be derived and tested in any one inertial frame. In particular, an account is given in one inertial frame for the dynamic causes of relativistic effects for simple accelerated clocks and rods. (auth)

8633 PATH-DEPENDENT POTENTIAL FOR QUANTUM ELECTRODYNAMICS WITHOUT VACUUM POLARIZATION. Fry, M. P. (Univ., Graz). Acta Phys. Austriaca; 39: No. 4, 325-344(1974).

It is shown that the charged particle propagators of spin-0 and spin-$\frac{1}{2}$ quantum electrodynamics without vacuum polarization can be calculated from the propagators of a charged spin-0 boson and an electron in a path-dependent potential. This result leads to a new equation for the once-amputated unrenormalized electron-photon vertex that may offer a useful approach to the calculation of the eigenvalue condition for a finite theory of quantum electrodynamics. (auth)

8634 FOUR-DIMENSIONAL DIRECTION VECTOR AND LORENTZ TRANSFORMATIONS. Kern, E. (Bundesrepublik Deutschland, Essen). Acta Phys. Austriaca; 39: No. 3, 274-287(1974). (In German).

In the four-dimensional space-time world a spatial direction can be characterized by a vector, that is by a zero-type four-vector N_α. Its components depend not only on the direction, but also on the velocity v of the body (or particle) to which the direction vector n is attached. The three-vector n must be defined by a Lorentz-invariant measurement rule. This succeeds when one interprets n as the direction of a photon emitted by the body. With the four-vector N_α one can, for example, characterize the spin direction of a particle or the polarization direction of a particle beam. Constant Lorentz transformations can be represented as the rotation of an orthogonal four-space. Each four-space can be assigned a three-space from zero vectors when the three space-like unit vectors of the four-space are replaced by the pertinent zero-like direction vectors. At the site of the zero three-space a three-space can be taken from the three-dimensional unit vectors which corresponds to the photon direction of the system of coordinates. Lorentz transformations therefore can be represented clearly and physically significantly as a motion of a usual three-space on the unit sphere. At sufficiently high velocities a three-dimensional system of coordinates, which is a valid system in the rest state, appears as a left-handed system. (tr-auth)

8635 FOUNDATIONS OF RELATIVITY. Aaberge, T. (Univ., Geneva). Helv. Phys. Acta; 48: No. 2, 163-171(25 Aug 1975).

A language is sketched in which to discuss the notion of relativity in general in connection with space-time coordinatization, and this language is applied to interpret the theory of special relativity. It is then argued that this theory does not give the only possible representation of "Einstein relativity", and to show this one gives a (nonlinear) realization of the Lorentz group on R^4 and uses this to arrive at the usual interpretation of the μ-meson experiment. Finally, one briefly introduces the notion of passitivity in a scheme which can serve as a basis for the construction of a Hamiltonian dynamics for Einstein relativistic particles. (auth)

8636 HAMILTONIAN DYNAMICS FOR EINSTEIN RELATIVISTIC PARTICLES: THE CLASSICAL PARTICLE AND THE QUANTAL PARTICLES OF SPIN 0 AND $\frac{1}{2}$. Aaberge, T. (Univ., Geneva). Helv. Phys. Acta; 48: No. 2, 173-190(25 Aug 1975).

A new Hamiltonian dynamics is presented for the description of Einstein relativistic particles. The theory is based on the idea of passivity in the Einstein relativistic case and is constructed by following a scheme similar to that followed by Piron in his study of the Galilei relativistic particles. The results obtained and presented indicate that the present theory may be considered as

a natural generalization of the Galilean–Hamilton dynamics, as well as the Wigner theory for free Einstein relativistic quantal particles. (auth)

8637 CLIFFORD ALGEBRAIC APPROACH TO SUPERFIELDS AND SOME CONSEQUENCES. Ktorides, C. N. (International Centre for Theoretical Physics, Trieste, Italy). J. Math. Phys. (N. Y.); 16: No. 10, 2123-2129(Oct 1975).

Frames provided by Clifford algebras C/sub n/ are considered for the purpose of expanding a field multiplet (containing, possibly, both bosons and fermions). After giving a brief--mainly geometrical--description of Clifford algebras, the main tools of the present scheme are introduced: a scalar product in C/sub n/, a conjugation operation, and a "Lorentz covariant derivative." It is described how these Clifford algebraic tools can be applied in order to obtain free massless Lagrangian expressions for a number of field theoretical models. It is also shown how gauge fields can arise within this scheme. It appears possible that the suggested formalism can lead naturally to spinor field operators as "gauge fields." A specific example which can lead to a two-component "gauge spinor" is discussed. Possible lines of investigation which could solidify this potentially rich approach are suggested. (1 figure, 1 table) (auth)

8638 CORES FOR OPERATORS IN QUANTUM MECHANICS. Schroeck, F. E. Jr. (Florida Atlantic Univ., Boca Raton). J. Math. Phys. (N. Y.); 16: No. 10, 2112-2113(Oct 1975).

It is shown that the set of finite linear combinations of the harmonic oscillator functions as well as the set of (Schwartz) functions of fast decrease form cores for a large class of operators on the space L/sub mu/^{2}(R/sup n)/, where mu is nice relative to Lebesgue measure. The results are applied to a variety of classes of classical potentials and their second-quantized analogs. (auth)

8639 TRANSPOSITION-INVARIANT EQUATIONS FOR THE UNIFIED FIELD THEORY. Tautz, M. F. (Northeastern Univ., Boston). Found. Phys.; 5: No. 1, 63-74(Mar 1975).

Within the framework provided by a recently developed variational method, transposition-invariant field equations for unified field theories are discussed. Systems that are, in addition, invariant under Weyl-type gauge transformations or lambda transformations are derived. It is found that in a weak field limit two of the systems contain the equations of general relativity and the covariant Maxwell equations for a charge-free region. (auth)

8640 PHYSICAL RATIONALE FOR SPECIAL RELATIVITY. Ruark, A. E. Found. Phys.; 5: No. 1, 21-36(Mar 1975).

The structure of the Lorentz transformation depends intimately on the conventional operations for measurement of lengths (L) and time intervals (T). The prescription for length measurement leads to justifiable utilization of Euclidean geometry over finite values of the coordinates. Then T-values can be regarded as ratios of length measurements within a suitably defined clock. In certain cases the synchronization process should be supplemented by measurements providing position certification. The Lorentz transformation emerges from three specific symmetry statements, assured by the nature of the L and T operations: (1) one-one correspondence of finite values of the coordinates of two inertial frames, (2) frame reciprocity, and (3) spatial isotropy. (Light signaling is not needed in this derivation. Afterward, it is assumed that light is indeed an agent moving with the common speed revealed by the transformation.) When rest masses are determined in the conventional fashion, the conservation of momentum and of energy follow from the kinematics--a result due to Einstein. (auth)

8641 RENORMALIZATION OF SUPERSYMMETRIC QUANTUM ELECTRODYNAMICS. Slavnov, A. A. (Inst. of Mathematics, Moscow). Teor. Mat. Fiz.; 23: No. 1, 3-10(Apr 1975). (In Russian)

An invariant renormalization procedure for the supersymmetric gauge theories is suggested. It is shown that in the supersymmetric quantum electrodynamics all the divergencies are removed by means of the unified renormalization procedure for the wave functions and masses of the fields of matter and the wave function of the gauge multiplet. (auth)

8642 ACCELERATION OF PARTICLES IN A NEIGHBORHOOD OF A NEUTRAL LINE OF MAGNETIC FIELD. Bulanov, S. V.; Sasorov, P. V. pp 231-232 of Uskorenie Chastits i Yadernye Reaktsii V Kosmose. Kocharov, G. E.; Dergachev, V. A. (eds.). Leningrad; Ordena Lenina Fiziko-Tekhnicheskii Institut im. A. F. Ioffe (1974). (In Russian)

From conference on particle acceleration and nuclear reactions in space; Leningrad, USSR (19 Aug 1974). See CONF-740851–.

The acceleration of charged particles in hyperbolic magnetic and uniform electric fields has been investigated. The acceleration process consists of direct acceleration by the electric field in nonadiabatic region near the neutral line and betatron acceleration in a drift region. Characteristic energy of accelerated particles is found in nonrelativistic and ultrarelativistic limits. The energy spectrum has the exponential form for the region of extreme high energies. (auth)

Gravitation and General Relativity

Refer also to abstracts 8166, 8172, 8368, 8421, and 8639.

8643 (ORO--240) TACHYONS AND COSMOLOGY. Sudarshan, E.C.G.; Narlikar, J.V. (Texas Univ., Austin (USA). Center for Particle Theory). Nov 1975. Contract AT(40-1)-3992. 31p. Dep. NTIS $5.00.

The propagation of tachyons in an expanding universe is discussed. It is shown that a primordial tachyon in the big bang universe cannot survive unless it had very large energy initially. In an indefinitely expanding universe the tachyon trajectory turns back in time. This time barrier is found to exist even in the quantum mechanical discussion of tachyons. This property is used to set limits on the mass of a tachyon. The possible astronomical checks on the hypothesis that neutrinos or photons may be tachyonic are also discussed. (auth)

8644 CLASSICAL GENERAL RELATIVITY: A CONSEQUENCE OF QUANTUM THEORY. Deser, S. (Brandeis Univ., Waltham, MA). pp 135-143 of Gravitational Waves and Radiations. Paris; Centre National de la Recherche Scientifique (1974).

From conference on gravitational waves and radiations; Paris, France (18 Jun 1973).

From the fundamental axiom of quantum mechanics in special relativity that all interaction is due to the exchange of particles, the work deduces: 1) the existence and properties of the self-interaction of gravitons, 2) that a classical limit of this quantum system exists at sufficiently low frequencies, and 3) that this limit is uniquely described by the Einstein equations. (IAA)

8645 ELASTIC MEDIUM SUBMITTED TO GRAVITATIONAL WAVES. Souriau, J. M. (Univ., Marseille). pp 243-255 of Gravitational Waves and Radiations. Paris; Centre National de la Recherche Scientifique (1974). (In French)

From conference on gravitational waves and radiations; Paris, France (18 Jun 1973).

Means of exactly treating the action of a gravitational wave on an elastic body are examined. The various methods of approximating what happens in certain circumstances are verified by comparison with each other. The equation of planar waves, the theorem of isometries, the study of geodesics, the action of the gravitational wave on a cloud of dust, and finally its action on the elastic medium are considered. (IAA)

8646 LIMITS ON TERRESTRIAL PRODUCED GRAVITATIONAL RADIATION. Halpern, L. (Univ., Brussels). pp 373-378 of Gravitational Waves and Radiations. Paris; Centre National de la Recherche Scientifique (1974).

From conference on gravitational waves and radiations; Paris, France (18 Jun 1973).

The limit on the gravitational radiation flux produced by earth and the features on which this flux depends are investigated theoretically in a large classical system that radiates coherent gravitational waves by the superposition of free oscillations of two different frequencies in a crystal. A prismatic cavity, in which the length is much larger than the base, is described, and the energy field resulting from the difference between the two frequencies is used to calculate the gravitational radiation flux along the z-axis. It is shown that the flux depends on the kinetic energy density, and that this method can be used with high precision at submillimeter wavelengths. (IAA)

8647 GRAVITATIONAL AND ELECTROMAGNETIC SHOCK WAVES. Lichnerowicz, A. (College de France, Paris). pp 47-56 of Gravitational Waves and Radiations. Paris; Centre National de la Recherche Scientifique (1974). (In French)

From conference on gravitational waves and radiations; Paris, France (18 Jun 1973).

A theory outlined in 1967 and developed in 1971 is used to separately examine gravitational and electromagnetic shock waves. The theory is based on the technique of distributions. The connections between gravitational shock waves and electromagnetic shock waves are studied. The propagation of discontinuities and the consequences of this propagation are also discussed. (IAA)

8648 FIVE-DIMENSIONAL UNIFIED FIELD THEORY: THE SOURCE FUNCTION. Browne, P. F. (Univ. of Manchester, Eng.). Found. Phys.; 5: No. 3, 387-398(Sep 1975).

In Kaluza's five-dimensional unified field theory the restriction for the 55 component of the metric tensor gamma$_{55}$ equals 1 demands that the 15 equations for the unified field be weakened. Equations which were proposed have identically vanishing trace. The equations then admit only a radiation field as source of the gravitational field. By relaxing the condition, this limitation is avoided, while retaining the striking successes of the five-dimensional approach. A scalar function, determined by the 15th field equation apart from integration constants, provides source terms for both the gravitational and electromagnetic fields, in the latter case of polarization type. (auth)

8649 REMARKS ON THE FOUNDATIONS OF GENERAL RELATIVITY. Pietenpol, J. L.; Speiser, D. (Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium). Helv. Phys. Acta; 48: No. 2, 153-161(25 Aug 1975).

A new way of introducing general relativity is presented, with emphasis on the physical meaning of the formalism and on its relation to classical mechanics. Also the crucial role of the experimental tests is underscored by pointing out the existence of two inequivalent but equally simple theories, both of which satisfy the principles of general relativity. (auth)

8650 GRAVITATION AND RIEMANNIAN SPACE. Lanczos, C. (Dublin Inst. for Advanced Studies). Found. Phys.; 5: No. 1, 9-18(Mar 1975).

The field equations of the quadratic action principle of relativity are solved, assuming a weak perturbation of the basic structure, which is a highly agitated Riemannian lattice field of a very small lattice constant. A field emerges which can be interpreted as the weak gravitational field of an apparently Minkowskian space. This field does not coincide with Einstein's theory of weak gravitational fields. Whereas the redshift remains unchanged, the light deflection becomes reduced by 11.1 percent of the value predicted by Einstein. (auth)

8651 STRUCTURAL EQUATIONS FOR KILLING TENSORS OF ORDER TWO. II. Hauser, I.; Malhiot, R. J. (Illinois Inst. of Tech., Chicago). J. Math. Phys. (N. Y.); 16: No. 8, 1625-1629 (Aug. 1975).

In a preceding paper, a new form of the structural equations for any Killing tensor of order two has been derived; these equations constitute a system analogous to the Killing vector equations Nabla/ sub alpha/ K/sub beta/ equals omega/sub alpha beta/ equals -omega/sub beta alpha/ and Nabla/sub gamma/ omega/sub alpha beta equals R/sub alpha beta gamma delta/ K/sup delta/. The first integrability condition for the Killing tensor structural equations is now derived. The structural equations and the integrability condition have forms which can readily be expressed in terms of a null tetrad to furnish a Killing tensor parallel of the Newman-Penrose equations; this is briefly described. The integrability condition implies the new result, for any given space-time, that the dimension of the set of second-order Killing tensors attains its maximum possible value of 50 only if the space-time is of constant curvature. Potential applications of the structural equations are discussed. (auth)

8652 EINSTEIN SHIFT IN EINSTEIN'S BOX EQUIPMENT. Treder, H. J. (Akademie der Wissenschaften, Potsdam, Ger.). Found. Phys.; 5: No. 1, 135-142(Mar 1975).

The question of whether the Einstein shift in clock rates has a bearing on the validity of the fourth Heisenberg uncertainty relation is discussed. It is shown that, even if one would accept all the relevant assumptions and conclusions of Bohr and Rosenfeld, this uncertainty relation could not be saved by an Einstein shift in the case of an electrostatic weighing. This means that the Einstein shift does not play any role in determining the validity of the fourth Heisenberg relation. (auth)

REACTOR TECHNOLOGY AND REGULATION

Refer also to abstract 8768.

8653 (JUL-1114-RG) PEBBLE BED HIGH TEMPERATURE REACTOR AS A SOURCE OF NUCLEAR PROCESS HEAT. II. Core Physics Studies. Teuchert, E.; Bohl, L.; Ruetten, H. J.; Haas, K. A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Oct 1974. 73p. INIS.

33 figs.; 24 tabs.; 23 refs.

A theoretical analysis is given for a series of 8 different variants of the pebble-bed reactor in the "once through" fuel management scheme. The comparison gives some insight into the parametric sensitivities and into the development potential of this type. The thorium/U-233 recycling fuel cycle allows the conversion ratio to be increased to between 0.90 and 0.95. The feasibility for a changeover between different fuel cycles under full power operation is discussed. The study is complemented by a review of the relevant previous investigations. (auth)

8654 CALCULATIONS CONCERNING THE PRIMARY COOLING CIRCUIT OF HELIUM-COOLED PEBBLE BED TYPE HIGH-TEMPERATURE REACTORS FOR PROCESS STEAM GENERATION. Baeumer, R. Aachen; Technische Hochschule (1973). 117p. (In German). INIS.

Thesis.

Following a description of the computer model to determine the thermodynamic data of the primary circuit, a nuclear and thermal reactor calculation is carried out. Furthermore, all important parameters in the thermodynamics of the cooling circuits are examined. In addition, a cost calculation of the whole plant is set up for the optimization of the number of coolant circuits. (GE)

8655 INDEXING NUCLEAR PLANT RECORDS. Zassenhaus, H.; DeGennaro, M.; Roper, D. Power Eng.; 79: No. 10, 48-51(Oct 1975).

A description is given of a computerized document filing system used in storage and retrieval of information relevant to the design, construction, and operation of nuclear power plants. (DG)

8656 TRAINING APPLICATION OF NUCLEAR POWER PLANT SIMULATORS. Ruzich, K. C.; French, J. L. New York; Institute of Electronic and Electrical Engineers, Inc. (1975). 8p. $2.00.

From IEEE PES summer meeting; San Francisco, CA, USA (20 Jul 1975).

A discussion is presented of why and how simulators are utilized to train and qualify nuclear power plant operating personnel. A typical training simulator is examined from the standpoint of its makeup and overall development. Various categories of training programs that utilize the simulator are covered in some detail. The USNRC requirements for operator qualification and eligibility are pointed out. Many advantages of simulator training are discussed, including its help in meeting the manpower needs of the fast growing nuclear power industry. (auth)

8657 SELECTION AND TRAINING OF INSTRUMENT AND CONTROL SPECIALISTS FOR NUCLEAR POWER PLANTS. Velotta, J. C.; Waylett, W. J. Jr. New York; Institute of Electronic and Electrical Engineers, Inc. (1975). 7p. $2.00.

From IEEE PES summer meeting; San Francisco, CA, USA (20 Jul 1975).

A program to select and train instrument and control specialists for work in Florida Power and Light Company's nuclear power plants is discussed. The Apprentice Instrument and Control Specialist Training Program, the Instrument and Control Specialist Training Program, and the Continuing Education Program are described in detail. The complete program offers a new employee the opportunity to obtain a four-year college degree. (auth)

8658 FRENCH ELECTRONUCLEAR POLICY. Giraud, A. (CEA, Paris). Armement; No. 24, 7-21(Feb 1973). (In French)

The most important reasons behind the acceleration of the French nuclear construction program are outlined. The nuclear electricity production program is presented (technical decisions, uranium enrichment) together with the research and development program for fast neutron breeder reactors, light water reactors, and high temperature gas reactors. (auth)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 8750, 8772, and 8811.

8659 (BNWL-SA-5557) EXPERIMENTAL VERIFICATION OF STORED ENERGY CALCULATIONS. Hann, C. R.; Christensen, J. A.; Lanning, D. D.; Marshall, R. K.; Williford, R. E. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 1975. Contract E(45-1)-1830. 15p. (CONF-750961-1). Dep. NTIS $4.50.

From 3rd annual water reactor safety information exchange; Germantown, Maryland, USA (29 Sep 1975).

A description is provided of irradiation tests designed to provide data needed to verify existing steady state fuel performance codes. The tests are being conducted in the Halden Reactor, and are designed to provide data pertinent to stored energy calculations over a range of linear heat ratings utilized in contemporary power reactors. (auth)

8660 (MRR-145, pp 91-107) MATHEMATICAL PROBLEMS IN THREE-DIMENSIONAL REACTOR CALCULATIONS. Werner, W. Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

Methods for three-dimensional calculations of the neutronics behavior of modern light-water reactors are discussed. It is shown that coarse-mesh methods, especially the expansion method are the most suitable for these calculations. It is also noted that further work is required to determine optimal time-integration procedures. (JWR)

8661 (MRR-145, pp 131-172) CONSISTENT NODAL METHOD FOR THE ANALYSIS OF SPACE-TIME EFFECTS IN LARGE LWR'S. Finnemann, H. (Kraftwerk Union AG, Erlangen, Ger.). Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany. Lab. fuer Reaktorregelung und Anlagensicherung).

The solution method of the computer code IQSBOX is discussed. IQSBOX solves the time dependent multidimensional neutron diffusion equation by a combination of nodal methods with weighted residual techniques. This nodal technique relies on 1D diffusion calculations for determining the spatial coupling coefficients. The 1D diffusion equations are solved by polynomial expansion. For this reason, the method has been called Nodal-Expansion-Method (NEM). Several results for static and dynamic problems are discussed which demonstrate the accuracy and computational efficiency of the method. (auth)

8662 (MRR-145, pp 173-189) SIMULATION OF TRANSIENTS WITH SPACE-DEPENDENT FEEDBACK BY COARSE MESH FLUX EXPANSION METHOD. Langenbuch, S.; Maurer, W.; Werner, W. Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

It is demonstrated that the coarse mesh expansion method developed for pure neutronics calculations retains to accuracy in LWR kinetics calculations which include the effects of strong space-dependent feedback. (JWR)

8663 (MRR-145, pp 413-503) SURVEY OF THE RESULTS OF A TWO- AND THREE-DIMENSIONAL KINETICS BENCHMARK PROBLEM TYPICAL FOR A THERMAL REACTOR. Christensen, P. S. (Danish Atomic Energy Commission, Risoe); Fayers, F. J.; Langenbuch, S.; McDonnell, F. N.; Schmidt, A.; Vincenti, E.; Yoshikawa, H.; Werner, W. Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

In 1973, NEACRP and CSNI posed a number of kinetic benchmark problems intended to be solved by different groups. Comparison of the submitted results should lead to estimates on the accuracy and efficiency of the employed codes. This was felt to be of great value since the codes involved become more and more important in the field of reactor safety. The results of the 2d and 3d benchmark problem for a BWR are presented. (auth)

8664 (ORNL-EIS-74-66, pp Paper 3) THERMAL ENERGY DISPOSAL METHODS FOR THE PROPOSED NUCLEAR POWER PLANT AT VERNON. Converse, A. O. (Dartmouth Coll., Hanover, NH). May 1974.

In cooling systems: towers, ponds, and once-through cooling. (Oak Ridge National Lab., Tenn. (USA)).

Several ways of cooling the proposed nuclear power plant are described, and estimates of the corresponding power costs are presented. The expected river temperatures and dissolved oxygen concentrations are presented as functions of the time of year. The problem of fog formation is discussed. Conclusions and recommendations are presented. (auth)

8665 (ORNL-EIS-74-66, pp Paper 12) SIMULATION AND EVALUATION OF FIVE THERMAL ENERGY DISPOSAL METHODS FOR A LARGE NUCLEAR POWER GENERATING STATION. Ramont, R. G. (Dartmouth Coll., Hanover, NH). 18 Feb 1972.

In cooling systems: towers, ponds, and once-through cooling. (Oak Ridge National Lab., Tenn. (USA)).

Design constraints are imposed to minimize the plant's effect on the environment. Systems utilizing air and combinations of air and evaporative cooling capabilities are emphasized. A cooling system using a refrigeration cycle is also described and evaluated. The Vermont Yankee Nuclear Power Plant at Vernon, Vermont is used as the base to which all systems are applied and compared. It is concluded that the most desirable alternative employs the direct condensation of steam within the finned tubes of air cooled heat exchangers. The cost for such a system is of the same order of magnitude as that of an evaporative cooling tower system. The power production cost for a plant with direct condensation system ranges from 4.203 to 4.320 mills/KWH. This compares to a cost of 4.223 mills/KWH for an evaporative cooling tower system. (auth)

8666 STORAGE DEVICE FOR FUEL CARTRIDGES. Suvanto, A. (to ASEA-ATOM AB). Swedish Patent 369,243. 12 Aug 1974. 3p. (In Swedish).

A description is provided of a storage device for fuel cartridges of quadratic cross section, comprising a storage lattice with quadratic panes, and also a number of tubes, that are made with a quadratic cross section, and designed to contain each its fuel cartridge, characterized by the fact that a number of square sides in the storage lattice are equipped each with its fixture adjusted to a couple of tube walls, parallel to one another, intersecting the mentioned square sides, each belonging to its fuel cartridge and separated by a split, that the mentioned couples of tube walls there enclose each its absorber film and are watertight choked on the upper and on the lower side. (SW)

8667 BOILING WATER REACTOR CORE. Fredin, B. (to ASEA-ATOM AB). Swedish Patent 359,395. 6 Dec 1973. 5p. (In Swedish)

A description is presented of a boiling-water reactor core, which is built up of a number of long-strip fuel cartridges, parallel to one another, with regular approximately square cross sections, each of which consists of a number of parallel, vertical fuel rods, disposed so as to take up the greater part of a number of positions, which are regularly distributed over the whole cross section of the fuel cartridges, which positions correspond to all the intersection points in a regular or at least mirror symmetric network, while the remainder of the above-mentioned positions, at least as many as four, are taken up by a single pipe, set up so that the water flows through it during the reactor operation, while at least in a central area of the core, each fuel cartridge is surrounded by a first and then a second couple of slits, at right angles to each other and adjacent to each other, which during the reactor operation contain water, where the first mentioned couple of slits is designed with a comparatively big gap width so as to include two arms in a control rod, made with a cruciform cross section, while the aforesaid other couple of slits is designed with a considerable smaller gap width, where the above-mentioned pipe is set up, so that the center of its cross section lies on the diagonal between the corner-points of the first and the second mentioned couple of slits, characterized by the fact that the above-mentioned pipe is at a relatively long distance from the corner of the above-mentioned first couple of slits, and at a relatively short distance from the above-mentioned second couple of slits. (SW)

8668 NUCLEAR POWER PLANT. Sterner, T. (to ASEA-ATOM AB). Swedish Patent 358,765. 15 Nov 1973. 8p. (In Swedish)

A description is presented of a nuclear power plant comprising a boiling-water reactor and at least two parallel connected steam turbines with their condensers and feed water pumps connected with the nuclear pile each one to its own regulating valve, as also a system for the adjustment of the water level in the reactor, characterized by the fact that the aforesaid device for each turbine includes a speed regulator for the feed water pump and an indicator for the turbine load, which indicator is designed to guide the speed regulator of the pump according to the load of the turbine, and that by means of a Switching-over device in such a way that, below a fixed load level, the pump is driven at low speed, at the same time as the regulating valve is adjusted to the desired water-flow, while beyond this load, the regulating valve is opened and the speed of the pump is adjusted in accordance with the required water-flow.

8669 CONTAINMENT DEVICE FOR THE ABSORPTION OF SMALL AND LARGE DISCHARGES OF VAPORIZED COOLING AGENT FROM A BOILING-WATER REACTOR. Andersson, G. (to ASEA-ATOM AB). Swedish Patent 368,109. 26 Sep 1974. 7p. (In Swedish)

A description is provided of a containment device for the absorption of small and large discharges of vaporized cooling agent from a boiling-water reactor, with a reactor pressure vessel and a biological protection enclosing it including a primary safety containment which encloses the reactor vessel and the biological protection that is so disposed as, in case of excess of a fixed inner pressure, to be automatically connected by way of tubes equipped with back-pressure valves with a basin filled with liquid, the normal level surface of which lies higher than the aforesaid primary safety containment, and constitutes a lower limitation surface for a secondary safety containment, the volume of which is larger than the volume in the mentioned safety containment. Whereby the reactor pressure vessel is equipped with a steam outlet pipe, running into one of the aforesaid safety containments and fitted with shut-off medium, characterized by the fact that the mentioned primary safety containment holds a condensation tank, filled with liquid, arranged below the reactor pressure vessel and connected with a cooling system, and that the mentioned steam outlet pipes are led down in the mentioned condensation tank, whereby the aforesaid shut-off medium is made up of a valve that is designed for repeated opening and shutting-off operations. (SW)

8670 NUCLEAR REACTOR CORE. Hannerz, K. (to ASEA-ATOM AB). Swedish Patent 362,308. 14 Mar 1974. 4p. (In Swedish)

A description is presented of a core for a nuclear reactor which consists of a number of fuel cells, containing fuel cartridges that are fitted close to one another, and inside the fuel cartridges, of absorber units, displaceable in the pipe and working together with the fuel cartridges, characterized by the fact that the pipe in a fuel cartridge is located on the periphery and fixed to an envelope encircling the fuel cartridge, whereby the pipe remains in the reactor at an exchange of fuel cells. (SW)

8671 CORE FOR A NUCLEAR REACTOR. Haga, I.; Persson, N. O.; Suvanto, A.; Toernblom, L. (to ASEA-ATOM AB). Swedish Patent 363,184. 18 Apr 1974. 11p. (In Swedish)

A description is provided of a core module for a nuclear reactor, which comprises fuel cartridges with the associated control rod unit and a driving device connected with the control rod unit, characterized by the fact each fuel cartridge rests on a separate installation tube, that all the installation tubes are fixed to one and the same installation plate, which plate rests on the stub of the driving device of the control rod unit in the bottom piece of the reactor tank. (SW)

8672 APPLIANCE IN A NUCLEAR REACTOR FOR THE CHUCKING OF THE STEAM TREATMENT UNIT OF THE REACTOR. Gunnarsson, C. (to ASEA-ATOM AB). Swedish Patent 363,185. 18 Apr 1974. 11p. (In Swedish)

A description is provided of an appliance in a nuclear reactor for the supporting of the steam treatment unit, the chief components of which are constituted by a moderator tank filler cap and steam separators, which are fixed to it, and also of the moisture separator unit, characterized by the fact that the moisture deflector unit is placed on top of the moderator tank filler cap, that elements are applied to the reactor tank filler cap to exert a compressive force upon the steam treatment unit against the moderator tank, to the extent that such an appliance is not protected by the Swedish patent 357 092. (SW)

8673 FUEL CARTRIDGE INTENDED FOR A BOILING-WATER REACTOR. Andersson, I.; van Santen, A. (to ASEA-ATOM AB). Swedish Patent 365,333. 27 Jun 1974. 5p. (In Swedish)

A description is presented of a fuel cartridge intended for a boiling-water reactor and comprising a number of vertical fuel rods disposed on a base plate, and a number of upper tube parts, placed between these, running vertically and meant, partly for control rod fingers, partly as water pipes, which are fastened to the above-mentioned base plate and led through it characterized by the fact that the above-mentioned upper tube parts each has its connecting piece located under the grid plate, for the connexion each with its lower tube part and for the fastening to the base plate, and that the above-mentioned lower tube parts are inserted, without appreciable play, each in its vertically directed above bevelled bore hole, and taken up in the base of the fuel cartridge, and also that the upper ends of the above-mentioned lower tube parts are each fixed to its connecting piece by means of a flexible connection. (SW)

8674 PUMP UNIT FOR INTERNAL WATER CIRCULATION IN A CONCRETE TANK. Kraemer, W. (to ASEA-ATOM AB). Swedish Patent 369,240. 12 Aug 1974. 5p. (In Swedish)

A description is provided of a pump unit for internal water circulation in a concrete tank, in a liquid filled reactor, the pressure container of which consists of a concrete tank, containing a pump wheel arranged inside the concrete tank and a cylindrical motor cover, inset in the base plate of the concrete tank and vertically disposed, which encloses a motor, connected with the pump wheel, that is equipped with medium for cooling by means of flowing through of high-pressure water of essentially the same pressure as the cooling medium of the reactor, characterized by the fact that the mentioned cooling body – which high pressure water encloses and through which low-pressure-water flows – is disposed. (SW)

8675 DEVICE FOR ADJUSTING AND FIXING OF A LINEARLY DISPLACEABLE OBJECT. Hellman, E. R. (to ASEA-ATOM AB). Swedish Patent 369,157. 12 Aug 1974. 6p. (In Swedish)

A description is provided of a device for the adjusting and fixing of a linearly displaceable object in one of several positions, comprising a main cylinder with piston and piston-rod, which is fitted by one of its ends to the mentioned object and by its other end to the fore side of the piston, and which is pressure-tight led through a front end wall into the main cylinder and delimits a space which is equipped with inlet opening for a pressure medium, characterized by the fact that several comparatively thin positional cylinders are butt-jointed to the main cylinder, whereby the piston-rods of the positional cylinders are disposed perpendicular to the back of the main piston, by means of a guide-piece, which is butt-jointed to the back end of the main cylinder, and formed with a hole for the end parts of the piston-rods and supplied with stop areas, intended for stop against the stop areas of the piston-rods. (SW)

8676 DEVICE FOR THE MEASURING OF THE FLOW OF THE COOLING AGENT THROUGH THE CORE OF A NUCLEAR REACTOR OF THE TYPE BOILER. Simon, A. (to Allmaenna Svenska Elektriska AB). Swedish Patent 360,496. 10 Jan 1974. 5p. (In Swedish)

A description is presented of a device for the measuring of the flow of the cooling agent through the core of a nuclear reactor of the type boiler in which at least pumps are placed in the reactor for the circulation of the cooling agent, characterized by the fact that a representative number of fuel cartridges in the core are combined with the flow giver for the determination of the volume of cooling flow that passes through respective cartridge, as also that a summing-up device is arranged so that it is supplied as input agent, with "out"-signals from the above-mentioned flow giver, as well as "out"-signals from a temperature sensing outfit, which is disposed in order to meter the average temperature in the cooling agent of the reactor near to the flow givers, as also that the summing-up device has an outlet on which a signal appears, that is representative for the total flow of the cooling agent through the reactor. (SW)

8677 OUTLET TO A PRESSURE TANK. Kaerker, S. R.; Bratland, K. (to Aktiebolaget Atomenergi). Swedish Patent 360,769. 17 Jan 1974. 8p. (In Swedish).

A description is given of an outlet to a pressure tank, which comprises an outer wall for example of concrete, which is coated on the inside with a lining and a tank lying within the lining, characterized by the fact that it is shaped in such a way that the tank is drawn out to an inner pipe, which has a first straight part, which stretches itself out from the tank, and a second straight part, which is in the main perpendicular to the first part, and that the lining is drawn out to an outer pressure-bearing pipe, which comprises a first and a second straight part, which are coaxial with the first, respectively the second straight part of the inner pipe, alternatively comprises only one straight part, which is coaxial with the second straight part of the inner pipe, where a double pipe is formed, comprising a first and a second straight part, alternatively a second straight part, and whereby the play between the outer and the inner pipes is so great as to allow maximum movements, and also that the inner and the outer pipes are united into an only pipe beyond the part of the double pipe that contains the second straight part of the inner pipe. (SW)

8678 BOILING WATER REACTOR. Margen, P. (to Aktiebolaget Atomenergi). Swedish Patent 358,250. 1 Nov 1973. 7p. (In Swedish)

A description is presented of a boiling-water reactor, including a reactor tank, an admission pipe for feed water, a core, which is located in the reactor tank for fissile fuel, through which the water flows upwards and in this way is brought to boiling, a stack, situated over the core for the upwards flowing mixture of water and steam, separators, situated over the stack for the water-and-steam mixture, an outlet pipe for the produced steam, as also a return zone through which the water flows back from the separators to the lower part of the core, characterized by the fact that the wall separating the stack from the return zone is equipped with openings through which the stack can be connected to the return zone in order to reduce the convection currents which develop owing to the difference in density of the water-and-steam mixture and of the water in the return zone, as also by the fact that controlling devices are arranged so as to regulate the size of the openings. (SW)

8679 NUCLEAR REACTOR. Margen, P. H. E. (to Aktiebolaget Atomenergi). Swedish Patent 366,139. 18 Jul 1974. 6p. (In Swedish)

A description is provided of a nuclear reactor, comprising a pressure vessel, a space for cooling water in the lower part of the pressure vessel, a reactor core located in the space for cooling water and containing nuclear fuel for heating the cooling water, with or without boiling, a space for steam at the top of the pressure vessel, a proportionately thin-walled cover that encloses the space for steam, a heat-insulating gas in the space between the cover and the wall of the pressure vessel, and also a pressure-compensating device so as, on the one hand to separate the steam from the heat-insulating gas, on the other hand to allow an equilization of the pressure in the steam and in the heat-insulating gas, characterized by the fact that the pressure compensating device is made up of a waterseal, situated in the pressure vessel, placed close by the normal water level in the reactor and formed in such a way that the water in the water seal communicates directly with the cooling water in the space for cooling water of the reactor, and also that devices are there to keep the water in the waterseal cold, in order to reduce the evaporation from the water level in the waterseal. (SW)

8680 METHOD TO AVOID STRESS CORROSION IN FUEL CAPSULES IN WATER-COOLED REACTOR. Lysell, G. (to Aktiebolaget Atomenergi). Swedish Patent 360,491. 10 Jan 1974. 4p. (In Swedish)

A description is given of a method to avoid stress corrosion in fuel capsules in a water-cooled nuclear reactor, comprising fuel rods of the type that contains an oxidized nuclear fuel surrounded by a capping of a zirconium alloy, characterized by the fact that the power is, for a brief period, increased so much above the desired power that the thermal expansion caused in the nuclear fuel by the raised temperature brings on a stretching during the flow of the material in the capping. (SW)

8681 CONTINUOUS CONTROL OF pH AND CHLORIDE CONCENTRATION IN WATER COOLANT OF NUCLEAR REACTORS. Moskvin, L. N.; Krasnopyorov, V. M.; Fokina, R. G.; Vilkov, N. Ya. At. Energ. (USSR); 38: No. 3, 143-145(Mar 1975). (In Russian)

The potentiometric method with cells having two identical electrodes is the most simple and reliable method for the continuous control of pH and chlorides in circulating water of nuclear reactors. Constant potential on the comparison electrode can be achieved by directing the solution-to-be-analyzed through an ion-exchange filter of mixed action. The feasibility of continuous registration of pH in a cell having two parallel glass electrodes is considered. For the control of chlorides, a cell version having two consecutive porous silver-chloride electrodes is used. The ability of such cells to function in water, simulating the heat carrier of water-cooled reactors, has been demonstrated. (auth)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 8659–8662, 8674, 8679–8681, 8750, and 8779.

8682 (ANCR-1223) LOFT FUEL MODULES DESIGN, CHARACTERIZATION, AND FABRICATION PROGRAM. Russell, M. L. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA). Idaho National Engineering Lab.). Sep 1975. Contract E(10-1)-1375. 90p. Dep. NTIS $5.45.

Progress is summarized in the areas of determination of fundamental high-temperature reactor material properties; design invention related to in-core instrumentation attachment; implementation of advanced and/or unique fuel bundle characterization techniques; implementation of improved fuel bundle fabrication techniques; and planning and execution of a multimillion dollar design, characterization, and fabrication program for pressurized water reactor fuel. (auth)

8683 (BAW-3647-35) PHYSICS VERIFICATION PROGRAM. Part IV, Task 1. Quarterly Technical Report, April–June 1975. Baldwin, M. N. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Research and Development Div.). Aug 1975. Contract AT(11-1)-3109. 31p. Dep. NTIS $5.00.

The reactivity and power perturbation effects of poison and neutral pins in mockups of 15 by 15 fuel assemblies are being measured. The experimental facility–a water-moderated, 4 percent enriched UO_2 lattice–is arranged to mock up the fuel assemblies of the Consolidated Nuclear Steam Generator (CNSG) core. (auth)

8684 (ORNL-EIS-74-66, pp Paper 98) COST COMPARISON OF DRY-TYPE AND CONVENTIONAL COOLING SYSTEMS FOR REPRESENTATIVE NUCLEAR GENERATING PLANTS. Rossie, J. P.; Cecil, E. A.; Young, R. O. (R. W. Beck and Associates, Denver). May 1974.

In cooling systems: towers, ponds, and once-through cooling. (Oak Ridge National Lab., Tenn. (USA)).

Results are presented of studies comparing the use of dry-type cooling towers with conventional cooling methods for representative pressurized-water-reactor nuclear power plants. The studies were based on the hypothetical use of dry-type cooling towers for three nuclear power plants now under construction which were designed and are being built to use conventional cooling methods. One of the plants is located in the northeastern United States, one in the Southeast and one in the West. The report also presents the results of comparisons based on a hypothetical plant at a typical eastern United States site. The three electric utilities which participated in these studies have furnished actual construction cost information for the conventional cooling systems being constructed, and the authors have made construction estimates for economically optimum dry cooling systems which might have been built in place of the conventional cooling systems being constructed. The report compares the physical and operating characteristics of dry-type and conventional cooling systems as well as the relative economics of the different cooling methods. The effect of dry cooling on the bus-bar cost of power has been computed for the three selected plants and for the typical eastern plant. (auth)

8685 (WARD-MRP-144) PRESSURIZED WATER REACTOR PROJECT. Technical Progress Report for the Period January 26, 1975–July 25, 1975. (Bettis Atomic Power Lab., West Mifflin, Pa. (USA)). 1975. Contract E(36-1)-GEN-14. 19p. Dep. NTIS $4.50.

Shippingport PWR Core 2, Seed 2 has remained shutdown since February 4, 1974, following a failure of the main unit turbine generator. Defueling of PWR-2 continued with head area component disassembly, main omega seal weld cutting, and removal of the reactor vessel head. Plant conditions are being maintained to support the defueling operation. The 1A, 1C, and 1D loops are isolated from the reactor vessel and in a dry layup condition. The 1B loop is open to the reactor vessel. The 1B loop, reactor vessel, and pressurizer are in a partially drained condition. A nitrogen atmosphere is being maintained in the 1B loop. The reactor vessel water level is being maintained within a narrow control band. Routine periodic preventative maintenance work is in progress. The 1A Reactor Coolant Pump was removed, sent off-site for refurbishment, and reinstalled. The 1A heat exchanger was removed and a spare unit placed into its position. Work has begun to remove the 1D heat exchanger for replacement with another spare unit. (auth)

8686 LARGE BUTTERFLY VALVE DESIGN COPES WITH OUT-OF-ROUND PIPE. Saar, R. P. Power Eng.; 79: No. 10, 53-55(Oct 1975).

Two 96 inch circulating water lines at the Trojan reactor were joined to butterfly valves which had to be distorted to conform to the badly out-of-round pipes. Bubble tight seating was achieved by positioning a flexible seat ring after the valve was installed. (DG)

8687 STUDY ON THE UNSTEADY FLOW IN THE TECHNICAL WATER SUPPLY CHANNEL TO KOZLODUI ATOMIC POWER STATION. Marinov, E.; Petrov, P. God. Energoproekt.; 14: 95-108(1972). (In Bulgarian)

A program for an electronic digital computer has been developed for unsteady flows in a trapezoidal channel. The heart of the program is a numerical solution of the differential equations of unsteady flow. The program can be used to predict the extremal water levels in the channel by sudden and complete disconnection of the pump-stations. Some illustrative examples are given applied to the channel of the power station "Kozlodui". (auth)

8688 FILTRATION RESEARCHES FOR THE TECHNICAL WATER SUPPLY OF THE KOZLODUI NUCLEAR POWER STATION. Abadzhiev, Kh.; Dimitrov, N.; Petrov, P. God. Energoproekt.; 14: 49-68(1972). (In Bulgarian)

A new method of modelling by the electrical analogy and results for the filtration investigation for the technical water supply of the Kozloduy nuclear power station are given. The model studies are accomplished using conducting paper, but the thin revetment of concrete modelling the filtration from the canals and forecasting of the ground water level in the region of the power station is simulated with discrete electrical resistances. The three-dimensional phenomenon of the filtration towards the excavation for the first pump station is simulated in two dimensions in plan, but the filtration resistance of the concrete wall and the previous basis are simulated by supplementary electric resistances. (auth)

8689 EFFECTS OF ISOCHRONAL ANNEALING ON PHYSICAL AND MECHANICAL PROPERTIES OF IRRADIATED Zr–1% Nb ALLOY. Gordienko, P. S.; Mayorshin, A. A. At. Energ. (USSR); 38: No. 3, 135-137(Mar 1975). (In Russian)

Physical and mechanical properties and micro-structure of Zr–1% Nb cladding of fuel elements in the first Novo-Voronezh Atomic Power Station core before and after isochronal annealing have been investigated. It has been shown that annealing specimens in the temperature interval 250-450°C somewhat increases strength properties and decreases plasticity. Increasing the annealing temperature to 580 C results in a redistribution of hydrides in the structure of specimens and in the recovery of mechanical properties. Changing the rate of heat release is characterized by two groups of peaks. (auth)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 7394, 8653, 8654, 8726, 8768, 8774–8777, 8803, and 8810.

8690 (AED-CONF-75-233-002) PURPOSE, RESULTS, AND STRUCTURE OF THE HHT PROJECT. Kraemer, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany)). May 1975. 17p. (In German). INIS.

From project high-temperature reactor with helium turbine-Status report; Juelich, F. R. Germany (2 Jun 1975).

Following an explanation of the purposes of the project, the results of the first phase of the investigation are described. The essential aims of the project were a most simple possible concept, a most extensive possible takeover of the HTR dual-cycle technique, the use of known materials and technologies, as well as the setting-up of a technical frictionless transition from a first plant to commercial use in the near future. Based on what has been achieved so far, a review of the problems yet to be solved is given. (GE)

8691 (AED-CONF-75-233-003) RELEASE AND DEPOSITION OF FISSION PRODUCTS. Mielken, G. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Projekt Hochtemperaturreaktor mit Heliumturbinen). 1975. 8p. (In German). INIS.

From project high-temperature reactor with helium turbine-Status report; Juelich, F. R. Germany (2 Jun 1975).

13 figs.

The release of fission products from coated fuel particles, the fission product carry-over and deposition in the reactor cycle by the coolant, and the decontamination of contaminated reactor cycle components of a high-temperature reactor with a helium

turbine are discussed. It is shown that Kr 88, which is released by coolant gas leakage and emitted through the chimney, makes up most of the inhalation dose, while Cs 134, Cs 137, I 131, and Ag 110m are the most important sources of γ-radiation which are of major importance in inspections and maintenance because of the deposits they form on the various components of the coolant cycle. (GE)

8692 (AED-CONF-75-233-005) DEVELOPMENT OF FUEL ELEMENTS FOR THE HTR REACTOR WITH A HELIUM TURBINE. Hackstein, K. G. (Hochtemperatur-Reaktor-Brennelement G.m.b.H. (HOBEG), Hanau (F. R. Germany)). 1975. 10p. (In German). INIS.

From project high-temperature reactor with helium turbine-status report; Juelich, F. R. Germany (2 Jun 1975).

1 fig.

The state of development of fuel elements is described whose particular objects are high gas temperatures and low fission product release rates. Of main importance are the development of fuel and fertile material kernels, the technology of coating as well as the design of fuel rods. (GE)

8693 (AED-CONF-75-233-006) HIGH-TEMPERATURE He PILOT PLANT. Koenig, H. (Nordwestdeutsche Kraftwerke A. G., Hamburg (F. R. Germany)). 1975. 11p. (In German). INIS.

From project high-temperature reactor with helium turbine-status report; Juelich, F. R. Germany (2 Jun 1975).

4 figs.

The tasks of the pilot plant as well as the state of the project are described. The plant is for preliminary tests which are to check the present knowledge and experience in the layout, construction, building and operation of open and closed gas turbines under conditions approaching normal operating conditions. (GE)

8694 (DP-Report-753) SOME HTR FUEL PIN STRESS PROBLEMS. Dragon Project. Kinkead, A. N.; Smith, E. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). May 1971. 42p. (CONF-710572-1). Dep. NTIS (US Sales Only) $5.25.

From meeting on stresses in graphite structure related to HTR design; Berkeley, California, USA (17 May 1971).

A review is given of methods adopted and developed by the Dragon Project to examine steady state operational and shut down stress problems arising in fuel pin design for high temperature reactors. The problem areas discussed include stresses at and far removed from pin ends, stresses caused by interaction between fuel compact and graphite pin components, and those caused by bowing. Reference is made to methods of thermal analysis used in arriving at temperature loading. 14 references. (auth)

8695 (EIR-284) PLAYGAS: A COMPUTER CODE FOR THE TRANSIENT ANALYSIS OF NUCLEAR GAS TURBINE POWER PLANTS. Dupont, J. F.; Cina, G.; Dang, M. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jul 1975. 14p. (CONF-750411-83). Dep. NTIS (US Sales Only) $4.50.

From European nuclear conference; Paris, France (21 Apr 1975).

To benefit fully from the high outlet temperature of HTGRs, gas turbine systems are subject to a growing interest in their application as direct cycle. Some results of a dynamical analysis performed for a HHT plant illustrate the dynamical aspects of nuclear gas turbine plants and give insight into the code performances. These results are followed by a brief code description. 5 references. (auth)

8696 (GA-A-13709) GAS TURBINE HTGR FOR ECONOMICAL DRY COOLING OR HIGH-EFFICIENCY COMBINED CYCLE. Krase, J. M. (General Atomic Co., San Diego, Calif. (USA)). 1 Oct 1975. Contract E(04-3)-167. 26p. (CONF-751119-2). Dep. NTIS $5.00.

From symposium on environment and energy conservation; Denver, Colorado, USA (3 Nov 1975).

The Gas Turbine High Temperature Gas-cooled Reactor (GT-HTGR) makes use of a helium-cooled graphite core to provide hot helium to a closed-cycle gas turbine power conversion system which operates on the reactor coolant helium. The helium gas turbines drive conventional electric generators to produce the electric output of the plant. The High Temperature Gas-cooled Reactor (HTGR) core, which is also used in the GT-HTGR, has been developed for commercial application in large central stations with a steam turbine-generator. (auth)

8697 (JUL-1226) IMPROVEMENT IN RETENTION OF SOLID FISSION PRODUCTS IN HTGR FUEL PARTICLES BY CERAMIC KERNEL ADDITIVES. Foerthmann, R.; Groos, E.; Gruebmeier, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Aug 1975. 32p. Dep. NTIS (US Sales Only) $5.00.

Increased requirements concerning the retention of long-lived solid fission products in fuel elements for use in advanced High Temperature Gas-cooled Reactors led to the development of coated particles with improved fission product retention of the kernel, which represent an alternative to silicon carbide-coated fuel particles. Two irradiation experiments have shown that the release of strontium, barium, and cesium from pyrocarbon-coated particles can be reduced by orders of magnitude if the oxide kernel contains alumina-silica additives. It was detected by electron microprobe analysis that the improved retention of the mentioned fission products in the fuel kernel is caused by formation of the stable aluminosilicates $SrAl_2Si_2O_8$, $BaAl_2Si_2O_8$ and $CsAlSi_2O_6$ in the additional aluminasilica phase of the kernel. 12 references. (auth)

8698 (LA-6062-MS) DEVELOPMENT PROGRAM FOR THE HIGH-TEMPERATURE NUCLEAR PROCESS HEAT SYSTEM. Jiacoletti, R. J. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1975. Contract W-7405-ENG-36. 22p. Dep. NTIS $4.00.

A comprehensive development program plan for a high-temperature nuclear process heat system with a very high temperature gas-cooled reactor heat source is presented. The system would provide an interim substitute for fossil-fired sources and ultimately the vehicle for the production of substitute and synthetic fuels to replace petroleum and natural gas. The dwindling domestic reserves of petroleum and natural gas dictate major increases in the utilization of coal and nuclear sources to meet the national energy demand. The nuclear process heat system has significant potential in a unique combination of the two sources that is environmentally and economically attractive and technically sound: the production of synthetic fuels from coal. In the longer term, it could be the key component in hydrogen production from water processes that offer a substitute fuel and chemical feedstock free of dependence on fossil-fuel reserves. The proposed development program is threefold: a process studies program, a demonstration plant program, and a supportive research and development program. Optional development scenarios are presented and evaluated, and a selection is proposed and qualified. The interdependence of the three major program elements is examined, but particular emphasis is placed on the supportive research and development activities. A detailed description of proposed activities in the supportive research and development program with tentative costs and schedules is presented as an appendix with an assessment of current status and planning. (auth)

8699 (MRR-145, pp 109-129) PARTIAL CURRENT BALANCE METHOD: A NEW COMPUTATIONAL METHOD FOR THE SOLUTION OF MULTIDIMENSIONAL NEUTRON DIFFUSION PROBLEMS. Burns, T. J. (Oak Ridge National Lab., TN); Dorning, J. J. Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

A new computational method for the solution of multidimensional neutron diffusion problems which is based on local balances of partial currents is described. After briefly motivating the ideas used in the method, the formalism is reviewed. The technique used for the solution of the final equations via local expansions is then described, and the resulting matrix equations are developed. The iteration schemes which were employed in the initial calculations are described. Computational results for two simple one-dimensional HTGR models and for a simple two-dimensional HTGR model are reported and compared with finite element and finite difference calculations for accuracy and computing time. In all cases studied, the partial current balance method compared very favorably with both these widely used methods. Some advantages of the partial current balance formulation are discussed. (auth)

8700 (ORNL-TM-5011) IRRADIATION PERFORMANCE OF HTGR FUEL RODS IN HFIR EXPERIMENT HRB-6. Homan, F. J.; Long, E. L. Jr.; Montgomery, B. H.; Hamner, R. L.; Valentine, K. H. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 49p. Dep. NTIS $5.45.

The HRB-6 Capsule was irradiated in the RB-5 facility of the High Flux Isotope Reactor (HFIR) for eight cycles. The primary purpose of this experiment was to test the then reference recycle fissile fuel–Bisco coated mixed thorium-uranium oxide. Among the several secondary objectives was to determine whether there was any difference in irradiation performance of ^{233}U and ^{235}U. Experiment HRB-6 was the first test of fully enriched (93 percent) ^{235}U in HFIR tests. Both slug injection and extrusion fabrication

techniques were used to prepare specimens for this test. No detectable difference between ^{233}U and ^{235}U irradiation performance could be seen from this experiment. The migration rates for the mixed oxide kernels measured for the HRB-6 specimens were consistent with such measurements made on similar kernels in other experiments. Analysis of the entire body of data on thermal migration for mixed oxide fissile kernels later led to the conclusion that this fuel was a marginal performer, and ultimately was replaced as the reference fuel by a uranium oxycarbide fissile kernel loaded from ion exchange resins. The observation of identical performance for ^{233}U and ^{235}U in the mixed oxide system was very important to the fuel development program. The recycle fuel development efforts have continued to use ^{235}U in subsequent irradiation tests, at considerably less expense than if ^{233}U test specimens were used. The very good performance of the test specimens fabricated using extrusion, relative to those fabricated using slug injection, was noted again in HRB-6. (auth)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstract 8817.

8701 (AECL-5035, pp 17-19) HYBRID COMPUTER: A POWERFUL TOOL FOR DYNAMIC SIMULATION. Moeck, E. O. (Chalk River Nuclear Labs., Ont.). Win 1975.

In AECL research and development in engineering, (Atomic Energy of Canada Ltd., Chalk River, Ont.).

The use of hybrid computers for the design and simulation of the next generation CANDU type reactors is described. (6 references) (DCC)

8702 (AECL-5035, pp 20-23) STEAM GENERATORS: A THREE DIMENSIONAL THERMAL HYDRAULIC SIMULATION. Mackie, C. J. Win 1975.

In AECL research and development in engineering. (Atomic Energy of Canada Ltd., Chalk River, Ontario).

To minimize tube failure, the designer requires some means of predicting the local thermal-hydraulic conditions to determine whether these conditions provide an environment which aggravates corrosion. A three-dimensional two-phase code entitled TRIP (Three-Dimensional Recirculating Flow Integrator in Polar Co-ordinates) has been used to undertake a thermal-hydraulic analysis of the secondary side conditions existing within the Bruce and G-2 (Gentilly) boilers. Examples of part of the output data are shown as plotted by the CALCOMP routine to minimize the effort involved in graphically representing large quantities of data. Such plots, if accepted as indicators of qualitative conditions existing within the boiler can be useful to the designer interested in modifying some of the local conditions. (auth)

8703 (AECL-5035, pp 34-39) DIGITAL SIMULATION OF A BOILING HEAVY WATER POWER REACTOR PLANT. Hawley, E. H. (Whiteshell Nuclear Research Establishment, Pinawa, Manitoba); Harrison, W. C.; Bell, R. P. Win 1975.

In AECL research and development in engineering. (Atomic Energy of Canada Ltd., Chalk River, Ontario).

Boiling in reactor channels introduces many problems which affect not only the reactor, but also the boilers and turbines. To predict how the system responds to different operating conditions is vital to the successful control and operation of the plant. Digital computer programs can be written to model plant performance. One such program is described. (auth)

8704 (EIR-259) HIGH-FLUX FAST MOLTEN SALT REACTOR FOR THE TRANSMUTATION OF CESIUM-137 AND STRONTIUM-90. Taube, M.; Ottewitte, E. H.; Ligou, J. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Sep 1975. 45p. Dep. NTIS (US Sales Only) $5.00.

A high flux molten salt (plutonium chlorides) fast reactor (7 GW(t)) with internal thermal zone for transmutation of Sr-90 and Cs-137 is discussed. These fission products have been produced by breeder reactors with total power of 23 GW(t) and by the 7 GW(t) fast burner reactor. The transmutation of Sr-90 and Cs-137 in a total flux of $3.8 \cdot 10^{16}$n $cm^{-2}s^{-1}$, and thermal flux ~ $2.0 \cdot 10^{16}$n $cm^{-2}s^{-1}$ can achieve the steady-state which corresponds to an effective half-life of 1.8 year for Sr-90 and of 8.9 years for Cs-137. In terms of hazard coefficient the transmutation system gives an improvement of 14 times. The impact of numerous parameters is discussed, e.g., chemical form of both nuclides, nature of moderator in thermal zone, moderator, layer, fuel composition, radius of thermal zone, ratio of burner/breeder reactors etc. The effects of replacing chlorides with fluorides as fuel for fast core is also discussed. (auth)

8705 (KFK-2133) ARGENTINE–GERMAN COOPERATION ON FUEL CYCLE OPTIMIZATION FOR THE NUCLEAR POWER PLANT ATUCHA. Progress Report, 1974. Zech, H. J. (ed.). (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Systemtechnik und Reaktorphysik). Jul 1975. 60p. Dep. NTIS (US Sales Only) $5.50.

The fuel cycle of the nuclear power plant at Atucha is described. Work performed in 1974 in this field under the Argentine-German co-operation agreement is reviewed. (auth)

8706 (MRR-145, pp 209-255) SPACE–TIME KINETICS OF CANDU SYSTEMS. Dastur, A. R.; Buss, D. B. (Atomic Energy of Canada Ltd., Mississauga, Ont.). Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

Characteristics of CANDU systems which affect space dependent neutron transients have been studied. Major factors have been found to be neutronic decoupling of reactor segments due to deliberate flattening of the power distribution; retardation of the power shape transient due to delayed neutron holdback; photoneutron production in heavy water; and asymmetric insertion of reactivity devices. A full scale excursion analysis in 3-dimensions is presented to show the degree and manner in which these characteristics contribute to produce the overall spatially-dependent neutron transients when a detailed model of the system is used in the simulation. (auth)

Power Reactors, Breeding

Refer also to abstracts 8745, 8747–8749, 8758, and 8769.

8707 (ANL-CT-76-14) TRANSPORT OF INERT GAS BUBBLES IN A LMFBR CORE. Minkowycz, W. J.; France, D. M.; Singer, R. M. (Argonne National Lab., Ill. (USA)). Aug 1975. 75p. AT.

Conservation equations are derived for the motion of a small inert gas bubble in a large flowing liquid-gas solution subjected to large thermal gradients. Terms which are of second order of magnitude under less severe and steady state conditions are retained thus resulting in an expanded form of the Rayleigh equation. The bubble dynamics is a function of opposing mechanisms tending to increase or decrease bubble volume while being transported with the solution. Diffusion of inert gas between the bubble and the solution is one of the most important of these mechanisms included in the analysis. The analytical model is applied to an argon gas bubble flowing in a weak solution of argon gas in liquid sodium. Calculations are performed for these fluids under conditions typical of normal and abnormal operation of a liquid metal fast breeder reactor (LMFBR) core and the resulting bubble radius, internal gas pressure, and mass of inert gas are presented in each case. An important result obtained indicates that inert gas bubbles reaching the core inlet of an LMFBR will always grow as they traverse the core under normal and extreme abnormal conditions and that the rate of growth is quite small in all cases. (auth)

8708 (ANL-RDP-42) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, JULY–AUGUST 1975. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. vp. AT.

Progress is summarized in the following research and development areas: Experimental Breeder Reactor No. 2, Hot Fuel Examination Facility, LMFBR Design Support, Instrumentation and Control, Fuels and Materials Development, Reactor Physics, Reactor Safety, and GCFR design. (auth)

8709 (ANL-Trans-986) MONITORING THE SEALING OF THE COMPONENTS OF THE PHENIX BLOCK REACTOR. Blanc, B.; Roulliay, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1975. Translation of CEA-CONF-1896. 16p. Dep. NTIS $4.00.

Among the controls done in the course of assembling the components of the reactor unit of Phenix, the welds in the principal pressure shell, the double casing, and the ceiling were leak tested by using helium. After several reminders concerning the structure of the reactor unit of the Phenix, the methods used for these con-

trols (a method called "venting"), and the nature of the monitoring done are described. (auth)

8710 (CONF-751101-45) GAS COOLED FAST REACTOR BENCHMARK CRITICAL ASSEMBLY. Bhattacharyya, S. K.; McKnight, R. D.; Robinson, W. R.; Bohn, E. M.; Rusch, G. K.; Martens, F. H.; LeSage, L. G. (Argonne National Lab., Ill. (USA)). Nov 1975. Contract W-31-109-Eng-38. 6p. Dep. NTIS $4.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

The GCFR Phase I assembly is the initial Gas-Cooled Fast Reactor Benchmark assembly on the ZPR-9 reactor at Argonne National Laboratory. It represents the first full scale mockup of a GCFR ever assembled. It is a clean, simple geometry benchmark reference for the 300 MW(e) GCFR Demonstration Plant designed by General Atomic Company. A description and the evaluated specifications (zero-excess reactivity critical mass and dimensions) of the benchmark assembly are presented. (auth)

8711 (CONF-751101-48) CENTRAL WORTH AND SPECTRAL MEASUREMENTS IN THE GCFR, Phase I Assembly. Morman, J. A.; Bhattacharyya, S. K.; Smith, D. M.; McKnight, R. D.; Yule, T. J.; Bohn, E. M. (Argonne National Lab., Ill. (USA)). Nov 1975. Contract W-31-109-Eng-38. 6p. Dep. NTIS $4.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

Central fission and capture rates, the central neutron spectrum and the reactivity worths of small samples were measured at the core center of the GCFR Phase I Assembly, the initial benchmark GCFR mockup assembly. Results of these measurements and comparisons with calculations are reported. (auth)

8712 (CONF-751101-51) PROCESS TECHNOLOGY FOR THE MOLTEN-SALT REACTOR $^{233}U-Th$ CYCLE. Hightower, J. R. Jr. (Oak Ridge National Lab., Tenn. (USA)). 1975. 37p. Dep. NTIS $5.00.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

After a brief description of the design features of the molten-salt breeder reactor, fuel processing for removal of ^{233}Pa and fission products is examined. Some recent developments in processing technology are discussed. (JWR)

8713 (COO-2245-16TR) POROUS BODY MODEL FOR PREDICTING TEMPERATURE DISTRIBUTIONS IN WIRE WRAPPED FUEL AND BLANKET ASSEMBLIES OF A LMFBR. Khan, E. U.; Rohsenow, W. M.; Sonin, A. A.; Todreas, N. E. (Massachusetts Inst. of Tech., Cambridge (USA)). Jun 1975. Contract AT(11-1)-2245. 213p. Dep. NTIS $8.75.

Existing methods of thermal analysis of a wire wrapped rod bundle of a Liquid Metal Fast Breeder Reactor are based on the principle of subchannel analysis. A model for thermal transport in wire wrapped rod bundles is developed here. The model is similar in principle to the one which has long been successfully used in chemical engineering for heat and mass transfer in fixed beds of packed solids. By dividing the bundle into two predominant regions and applying the model of a porous body to a LMFBR assembly a simple procedure for calculating temperature distributions in LMFBR fuel and blanket assemblies has evolved. The results obtained were found to predict available data with as good a precision as do the more complex analyses. Correlations for the two empirical constants were obtained as functions of geometric parameters based on an extensive analysis of existing data. The LMFBR fuel assemblies operate in forced convection (negligible natural convection) under steady state conditions whereas the blanket assemblies may operate in forced or mixed convection (combined forced and free convection). Two different formulations of equations, corresponding to these two convection regimes, were developed using the same basic model. The calculation procedure for assemblies in forced convection (called ENERGY I) is considerably simpler than that (ENERGY II, ENERGY III) in mixed convection, where buoyancy effects become important. Therefore it is desirable to use ENERGY I for forced convection (although ENERGY II, III can also be used in forced convection, the computational times are fifteen fold greater). In order to determine when buoyancy effects become important a new criterion is developed. Given the power, the power skew, the operating and geometric characteristics of the bundle, the critical modified Grashof Number predicts when buoyancy effects become important. (auth)

8714 (COO-2245-17TR) INPUT PARAMETERS TO THE ENERGY CODE (TO BE USED WITH THE ENERGY CODES MANUAL). Khan, E. U.; Rohsenow, W. M.; Sonin, A. A.; Todreas, N. E. (Massachusetts Inst. of Tech., Cambridge (USA)) May 1975. 22p. Dep. NTIS $4.50.

Recommended values of input data required by ENERGY code users are presented. (JWR)

8715 (COO-2245-18TR) MANUAL FOR ENERGY I, II, III COMPUTER PROGRAMS. Khan, E. U.; Rohesnow, W. M.; Sonin, A. A.; Todreas, N. E. (Massachusetts Inst. of Tech., Cambridge (USA)). May 1975. 113p. Dep. NTIS $6.50.

The ENERGY codes for predicting coolant temperature distributions in LMFBR were wrapped fuel and blanket assemblies are described. The mathematical models, data input, code listings, and sample problems are presented. (JWR)

8716 (COO-2250-2) LMFBR BLANKET PHYSICS PROJECT PROGRESS REPORT NO. 2. Forbes, I. A.; Driscoll, M. J.; Rasmussen, N. C.; Lanning, D. D.; Kaplan, I. (eds.). (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). 30 Jun 1971. Contract AT(11-1)-3060. 136p. (MITNE-131). Dep. NTIS $7.00.

This is the second annual report of an experimental program for the investigation of the neutronics of benchmark mock-ups of LMFBR blankets. Work was devoted primarily to measurements on Blanket Mock-Up No. 2, a simulation of a typical large LMFBR radial blanket and its steel reflector. Activation traverses and neutron spectra were measured in the blanket; calculations of activities and spectra were made for comparison with the measured data. The heterogeneous self-shielding effect for ^{238}U capture was found to be the most important factor affecting the comparison. Optimization and economic studies were made which indicate that the use of a high-albedo reflector material such as BeO or graphite may improve blanket neutronics and economics. (auth)

8717 (GEAP-13771-15) CRITICAL EXPERIMENTS AND ANALYSIS. Fifteenth Quarterly Report, April–May–June 1975. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Jul 1975. Contract AT(04-3)-893. vp. AT.

Current activities and technical progress are reported for critical experiments and analysis as applicable to LMFBR commercial plants and the Clinch River Breeder Reactor Plant Benchmark Critical Experiments in ZPPR Assembly 4 and the CRBRP EMC. Additional studies are directed toward the development of LMFBR plant calculational methods that also can be used at the sites of the Clinch River Breeder Reactor to determine the reactor power distribution, reactivity and fuel status, and for consideration of alternative fuel and control management schemes. (auth)

8718 (GEAP-14064) INFLUENCE FUNCTION ALGORITHM FOR PREDICTING POWER DISTRIBUTIONS AND CONTROL WORTHS. Cowan, C. L.; Choong, T. P.; Russell, C. S. (General Electric Co., Sunnyvale, Calif. (USA). Breeder Reactor Dept.). Jul 1975. Contract AT(04-3)-893. 53p. AT.

An influence function algorithm for predicting the effects of control rod movements on the three-dimensional power distributions and control worths in LMFBR plants has been specified. The algorithm provides a capability for carrying out rapid fuel management computations which can be utilized in LMFBR fuel burnup scoping studies and in the on-site surveillance, evaluation and planning of reactor performance. The influence function in terms of a practical computational tool is described. Particular emphasis is placed upon the incorporation of the influence function approach in the interpolative fuel management code FUMBLE to provide for the effects of control movements on the fuel burnup calculations. 5 references. (auth)

8719 (KFK-1274/4, pp v) CORROSION TESTS AND COOLANT ANALYSIS. Borgstedt, H. U.; Schnieder, H.; Nold, E.; Schumann, H.; Leistikow, S.; Kraft, R.; Pott, E.; Drechsler, G.; Frees, G. May 1975. (In German).

9 figs.; 3 tabs.; 3 refs.

In 4th quarterly statement 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

The results of 7,500 hours of high temperature corrosion experiments on cladding tube samples under sodium show linear time laws with respect to the decrease of the wall thickness. The samples had formed a continuous thin ferritic layer which was followed by a layer of high carburization. As temperature dropped, carbon concentrations increased, but carbon penetrations decreased. 1.4981 type steel shows a higher creep rate than the 1.4970 and 1.4988 type steels. The behavior observed on the welds of the end plugs of the samples did not greatly differ from the corrosion phenomena in the tube material. The corrosion of special materials for distance pads gives rise to fissures which may affect tribological properties. Corrosion experiments carried

out up to 2,500 hours on cladding materials under helium with water and hydrogen doping resulted in a paralinear time law for the increase in weight of 1.4970 and in a cubic root time law for 1.4981 and 1.4988. (auth)

8720 (KFK-1274/4, pp v) EXPERIMENT IN SODIUM TECHNOLOGY. Thermofluid-dynamical Experiments in Gas. Draft Studies for Gas-Cooled Breeder Reactors. Kadlec, J.; Appelt, K. D.; Wild, E.; Mack, K. J.; Weinberg, D.; Dres, K.; Rastetter, V.; Voeller, H.; Kolodziej, M.; Moeller, R. May 1975. (In German).

12 figs.; 2 tabs.; with refs.

In 4th quarterly statement 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

Temperature distributions in the outlet cross section of a turbulent sodium flow were measured in 61-pin bundles. In a supplementary experiment, velocity profiles were determined in water on a 19-pin bundle, which indicated design possibilities for a symmetrical flow at the entrance of the bundle. The influence of gas bubbles on cladding tube temperature transients in SNR fuel elements was determined theoretically under specific boundary conditions. Hydraulic studies on the model of the absorber of the secondary shutdown unit of SNR produced results on the influence of the most important design details with respect to pressure drop and flow distribution. With respect to gas cooled breeders, measurements of the pressure drop and the temperature distribution on pin bundles with artificial roughnesses are covered. (auth)

8721 (KFK-1274/4, pp v) FUEL PIN DEVELOPMENT. Elbel, H.; Lopez Jimenez, J.; Wedemeyer, H.; Nagel, H.; Wittmann, M.; Orians, H.; Vollath, D.; Ganguly, C.; Goetzmann, O.; Hofmann, P. May 1975. (In German).

13 figs.; 5 tabs.; with refs.

In 4th quarterly statement 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

The interaction between the thermal behavior and the respective materials properties, e.g., oxygen distribution as a function of the burnup of a fuel pin, was investigated in a theoretical parameter study. A non-destructive method has been developed for the experimental assessment of the O/M ratio which offers some advantages over the thermogravimetric method. X-ray diffraction methods were studied in greater detail to determine solid solution fractions in mixed oxide fuel. Radiographic methods have been further developed, also for the phase analysis of carbide fuels. Irradiation examination of the DFR-455 60-pin bundle (mixed oxide fuel) revealed major damage to the claddings of 4 pins. Results of the irradiation examinations of the FR 2 test group 5a have been evaluated. Major cladding expansions were observed as a result of mechanical interactions with the fuel. The FR 2 in-pile experiments on carbide test fuel pins in capsules attained burnups on the order of 7.5%. Microprobe post-irradiation examination results are available of FR 2 experiments on carbide pins of the 4a loop test group. Among other factors, these results show that there is transport of oxygen impurities in the direction of the cladding. This may give rise to compatibility problems as in the case of mixed oxide fuel pins. (auth)

8722 (KFK-1274/4, pp v) MATERIAL STUDIES. Schaefer, L.; Schirra, M.; Jacobi, O.; Scherwinsky, R.; Wassilew, C.; Closs, K. D.; Herschbach, K.; Ehrlich, K.; Schneider, W.; Venker, H. May 1975. (In German).

8 figs.; with refs.

In 4th quarterly statement 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

Cladding tubes were studied with respect to the influence of mechanical and thermal pre-treatments in order to optimize the mechanical properties and the in-pile behavior. Measurements of the swelling rates of simulation-irradiated samples of 1.4981 type steel seem to indicate that the swelling exponent of the solution-annealed material condition is lower than the corresponding exponent for the 20% cold-worked condition. (auth)

8723 (KFK-2158) DETECTION OF OSCILLATORY COMPONENTS IN NOISE SIGNALS AND ITS APPLICATION TO FAST DETECTION OF SODIUM BOILING IN LMFBR'S. von Ehrhardt, J. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Sep 1975. 178p. (In German). Dep. NTIS (US Sales Only) $8.50.

Thesis.

Disturbances in a reactor are possible which generate small oscillatory components in the measured signals. In general, these oscillatory components do not influence the mean value of the signals and consequently do not activate the conventional control system; however they can be found by analysis of the signal's noise component. For the detection of these oscillatory signals the observation of the frequency spectra of the noise signals is particularly advantageous because they produce peaks at the oscillation frequencies. A new detection system for the fast detection of suddenly appearing peaks in the frequency spectra of noise signals is presented. The prototype of a compact detection unit was developed which continuously computes the power spectral density (PSD) of noise signals and simultaneously supervises the PSD for peaks in the relevant frequency range. Theoretical results were confirmed in a number of experiments; special experimental and theoretical parameter studies were done for the optimal detection of sodium boiling in LMFBR's. (auth)

8724 (LA-6095-MS) CONSEQUENCES OF SODIUM BOND LOSS FROM AN LMFBR CARBIDE FUEL ELEMENT. Kerrisk, J. F. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. Contract W-7405-ENG-36. 20p. Dep. NTIS $4.00.

The consequences of sodium bond loss from a uranium-plutonium carbide fuel element during normal steady state operation have been assessed. The elements considered are typical of those currently being irradiated in EBR-II, and include elements with and without shroud tubes. The analysis presented is very conservative in that the many simplifying assumptions required were made to predict worse consequences than would be found in a realistic analysis. Following sodium bond loss, fuel melting occurs, but the fuel rapidly resolidifies after slumping out to contact the clad. Even if molten fuel were lost through an existing clad failure, the maximum fuel temperatures attained are below those required to initiate a vapor explosion in the sodium coolant. The small amount of molten fuel that might escape through an existing clad failure would have little or no effect on adjacent elements. (auth)

8725 (LMEC-75-1) LIQUID METAL ENGINEERING CENTER (LMEC) ANNUAL TECHNICAL PROGRESS REPORT, JANUARY--DECEMBER 1974. (Liquid Metal Engineering Center, Canoga Park, Calif. (USA)). 15 Mar 1975. Contract AT(04-3)-700. 533p. AT.

Information is presented on the development and testing of LMFBR components and systems, including FFTF pump seal test; FFTF dump heat exchanger testing; FFTF prototype pump testing; FFTF secondary isolation valve testing; materials compatibility in sodium; Sodium Pump Test Facility (SPTF) valve testing and mixing tee water tests; sodium level and pressure transducer testing; proximity transducer testing; electric resistance heater testing; sodium-to-gas leak detection tests; sodium fire suppression; LMFBR materials and component procurement standards; magnesium oxide purity tests; pipe examination after long-term sodium service; vanadium wire method for oxygen analysis; sodium pump failure investigation; Sodium Components Test Loop hydraulic system performance; automatic and machine welding experience; and SPTF feed and drain tank stress analysis. (HDR)

8726 (ORNL-TM-5093) NEEDS FOR DEVELOPMENT IN NONDESTRUCTIVE TESTING FOR LMFBR AND OTHER ADVANCED REACTOR SYSTEMS. McClung, R. W. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 75p. AT.

The needs for development of nondestructive testing techniques and equipment were surveyed and analyzed to resolve problem areas for the Liquid-Metal Fast Breeder Reactor, the Molten-Salt Breeder Reactor and the Advanced Gas-Cooled Reactor. The developmental needs that are broad-based requirements in nondestructive testing and the respective methods and applicable, in general, to all components and reactor systems are discussed. Next in order are the requirements of generic materials and components (e.g., steam generators) that are common to all reactor systems. These are followed by sections specific to materials and components peculiar to each of the three cited reactor systems. The methods-oriented needs and recommendations include improved reliability and quantitativeness, flaw characterization, and data processing as well as many comments specific to such methods as ultrasonics, eddy currents, acoustic emission, radiography, etc. The cited needs common to all reactors include those related to materials properties and degradation, welds, fuels, piping, steam generators, etc. In the sections on specific reactors, the needs of the above (and other) items that are peculiar to the given reactor system are emphasized. The scope of applicability ranges from initial design and material development stages through process control and manufacturing inspection to in-service examination. (auth)

8727 (SAND-75-0223) THEORETICAL STUDIES OF FLASH X-RAY DIAGNOSTICS FOR FUEL MOTION EXPERIMENTS. Halbleib, J. A. Sr.; Phillips, A. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1975. 40p. Dep. NTIS $4.00.

The results of preliminary theoretical studies concerning the

possible employment of short-pulse, high-current field emission diodes as sources for the flash x-ray diagnostics of fuel-pin motion are reported. The predicted thick-target photon environments are obtained from state-of-the-art coupled electron/photon transport models. Through qualitative figures of merit these environments are used to study the importance of source current and voltage. For a selected experimental configuration a comparison is made between the absolute flash x-ray imaging signals predicted for these environments and Monte Carlo/analytic calculations of absolute fission-gamma backgrounds. These preliminary data suggest that field emission sources operating at voltages in the 1- to 5-MeV range and at currents of the order of 100-kA or greater may be adequate diagnostic sources for test-pin configurations as complex as a full LMFBR subassembly. (auth)

8728 (WAPD-TM-1199) FLOW PATTERNS IN HIGH PRESSURE TWO-PHASE FLOW: A VISUAL STUDY OF WATER IN A UNIFORMLY HEATED 4-ROD BUNDLE (LWBR DEVELOPMENT PROGRAM). Williams, C. L.; Peterson, A. C. Jr. (Bettis Atomic Power Lab., West Mifflin, Pa. (USA)). Nov 1975. Contract E(36-1)-GEN-14. 83p. Dep. NTIS $6.00.

Flow patterns that occur in a rod bundle with forced upward flow of boiling water have been photographed. The experimental rod bundle consisted of four vertical 0.25-inch diameter by 24.0 inch long rods arranged in a single row. The tested conditions were: pressure–400 to 2000 psia, mass velocity–250,000 to 4,000,000 lb/hr-ft^2, and heat flux (uniform)–up to 1,600,000 Btu/hr-ft^2. The observed two-phase flow patterns were bubble flow, froth flow, slug flow, and annular flow. The flow patterns were mapped at constant pressure on plots of mass velocity versus flowing quality. (auth)

8729 (WARD-SG-3045-1(Vol.2)) ALTERNATE STEAM GENERATOR DEVELOPMENT PROGRAM. Phase I, Summary Report, September 1974--December 1974. Volume 2. Evaluation of Alternate Secondary System Fluids for LMFBR Plants. Cooper, M. H.; Lee, P. K. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Oct 1975. Contract E(11-1)-3045. 90p. AT.

The feasibility of mitigating potential sodium-water reactions in the steam generator of the Liquid Metal Fast Breeder Reactor (LMFBR) by substituting a less reactive fluid in the secondary loop was investigated by surveying potential alternate coolants. Physical properties of candidate fluids, including liquid elements, molten salts, simple gases, dissociating gases, organics, and fluid-solid suspensions were tabulated. Performance of these fluids was evaluated on the basis of required heat transfer area and pumping power for a typical steam generator design, chemical reactivity with sodium and water, materials compatibility, thermal stability, and irradiation stability. No suitable fluid superior to sodium was identified for use at the reference plant conditions; Dowtherm A could be substituted for sodium in reduced temperature plants with maximum secondary system temperatures of 427^{0}C (800^{0}F). Lead-bismuth alloy is recommended as a thermal bond in conduction-type alternate steam generator, since it is relatively non-reactive with sodium and water, corrosion is minimal in a non-circulating system, and its vapor pressure is minimal. (auth)

8730 EVOLUTION OF HEAT-EXCHANGER DESIGN FOR SODIUM-COOLED REACTORS. Mueller, R. A.; Schnauder, H. (Kernforschungszentrum, Karlsruhe, Ger.). At. Energy Rev.; 13: No. 2, 215-323(Jun 1975).

Following a review of the properties of liquid sodium, the intermediate heat exchangers and steam generators of the mainly lower-rated sodium-cooled reactor facilities that have been operated so far are briefly described. The design aspects, the available materials, and the design and calculation methods for the heat exchangers of larger sodium-cooled breeder reactors are treated in more detail. The intermediate heat exchangers and steam generators already designed, some of which are at present under construction or in the commissioning state, are described as examples. The test facilities used in the development are briefly mentioned. (auth)

8731 TEST RESULTS PROVE LMFBR HEAT EXCHANGER CONCEPT. MacDonald, J. S. (Atomics International Div., Canoga Park, CA). Energy Int.; 12: No. 10, 33-36(Oct 1975).

The development and testing programs of the steam generator design to be used in the U. S. LMFBR program are reviewed. (DCC)

8732 MASS YIELDS IN THE FISSION OF URANIUM-235 AND PLUTONIUM-239 IN THE NEUTRON SPECTRUM OF A GAS-COOLED FAST REACTOR. Rajagopalan, M.; Pruys, H. S.; Gruetter, A.; von Gunten, H. R.; Hermes, E. A.; Richmond, R.; Rossler, E.; Schmid, A.; Wydler, P. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen, Switzerland). Nucl. Sci. Eng.; 58: No. 4, 414-419(Dec 1975).

The yields of 27 mass chains in the fission of ^{235}U and the ratio of fast-neutron to thermal-neutron fission yields of 21 mass chains in the fission of ^{239}Pu induced by fast neutrons (median energy approximately 180 keV) have been measured in the reactor PROTEUS. The yields were obtained by a comparison method using gamma-ray spectroscopy. The data show that, in agreement with other authors, yields in the peaks of the mass distribution do not change compared to thermal-neutron-induced fission. (auth)

8733 MAIN RESULTS OF OPERATING THE BOR-60 FACILITY. Kazachkovski, O. D.; Afanasev, V. A.; Gryazev, V. M.; Kevrolyov, V. P.; Kondratev, V. I.; Nechaev, B. N.; Smirnov, A. M. At. Energ. (USSR); 38: No. 3, 131-134(Mar 1975). (In Russian).

The results of long-term, continuous operation of the BOR-60 atomic power facility, producing energy since December 1969, are generalized. During this time, various components have been tested: several types of fuel elements under high load and temperature conditions (12% burn-up has been achieved); absorbing materials for control and safety rods; basic and auxiliary equipment; steam generators. In addition, stationary, transient and emergency regimes have been investigated, and sodium technology (including under repair conditions) has been developed. The obtained operating experience may be used in developing the next generation of fast reactors. (auth)

Research, Test, and Experimental Reactors

Refer also to abstracts 8708, 8725, 8760, 8761, and 8767.

8734 (CONF-751116-9) ZPR-9 AIRBORNE PLUTONIUM MONITORING SYSTEM. Rusch, G. K.; McDowell, W. P.; Knapp, W. G. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 8p. Dep. NTIS $4.50.

From nuclear science symposium; San Francisco, California, USA (17 Nov 1975).

An airborne plutonium monitoring system which is installed in the ZPR-9 (Zero Power Reactor No. 9) facility at Argonne National Laboratory is described. The design and operational experience are discussed. This monitoring system utilizes particle size and density discrimination, alpha particle energy discrimination, and a background-subtraction techique operating in cascade to separate airborne-plutonium activity from other, naturally occurring, airborne activity. Relatively high sensitivity and reliability are achieved. (auth)

8735 (KFK-1274/4, pp v) PAPERS ON THE FUEL CYCLE. — Physical Experiments. — Reactor Theory. Stamm, H. H.; Boehme, R.; Fehsenfeld, P.; Jourdan, G.; Scholtyssek, W.; Kiesel, R.; Beer, H.; Kaeppeler, F.; Roller, D.; Rupp, G. May 1975. (In German).

10 figs.; 6 tabs.; with refs.

In 4th quarterly statement 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

The initial breeding ratio of the SNEAK 9B assembly has been determined by means of calculation and experimentally. For this purpose, the integral capture rate in U-238 and the integral fission rate of Pu-239 were measured. Criticality calculations were carried out for SNEAK 9C (assemblies with "dirty" plutonium) and compared with the experiment. As a result of measurements on the Van-de-Graaff accelerator, evaluated data of U-235 are available. Some of the cyclotron data available are differential elastic neutron cross-sections of Ca-40 which play a role in shielding problems. (auth)

8736 (LA-6031-MS) CONCEPTUAL DESIGN FOR A FAST REACTOR SAFETY TEST FACILITY. Preliminary Report. Allen, J. D.; Cort, G. E.; McLaughlin, T. P.; Palmer, R. G. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1975. 75p. Dep. NTIS $5.45.

In May 1975 Los Alamos Scientific Laboratory issued a preliminary report on a study of Fast Reactor Safety Test Facilities. The study addressed itself to three closely related tasks. (1) A review of the current understanding of fast reactor safety with the aim of identifying important areas of uncertainty which cannot be adequately resolved using analysis, out of pile and/or existing in-pile facilities. (2) Conceptual design studies of one or more new in-pile facilities having characteristics identified in (1) above. (3) An examination of advanced data acquisition techniques for possible incorporation in the new facilities. The work reported is an extension of the earlier work in task area (2) above. Based largely on

conclusions drawn from the earlier work the scope of the current effort has been narrowed to the design study of a Type A facility operating in the Class III mode, i.e., a facility capable of accommodating up to 37 test pins and capable of imposing a burst on top of a high steady state power level. (auth)

8737 (ORNL-TM-5009) BULK SHIELDING FACILITY QUARTERLY REPORT, JANUARY, FEBRUARY, AND MARCH OF 1975. Hurt, S. S. III; Lance, E. D.; Thomas, J. R. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 25p. Dep. NTIS $4.00.

The BSR operated at an average power level of 1,942 kw for 66.95 percent of the time during January, February, and March. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The BSR was operated at low and variable power during this quarter for 36,190 hours as part of the training programs for Tennessee Valley Authority (TVA) personnel from Sequoyah. The PCA was also used in the above-mentioned training program and was operated on twenty-six occasions when nuclear engineering students from the University of Oklahoma, the University of Tennessee, and TVA personnel actively participated in training laboratories. (auth)

8738 (ORNL-TM-5055) HFIR INSTRUMENTATION ERROR ANALYSIS. Roberts, M. J. (Oak Ridge National Lab., Tenn. (USA)). Dec 1975. Contract W-7405-eng-26. 31p. Dep. NTIS $5.00.

The accuracies of the measurements of operating conditions made by the electronic safety system at the High Flux Isotope Reactor were calculated theoretically. The technique was small-signal sensitivity analysis of the errors as they accumulated through cascaded instruments in various systems. The error bounds (for 99.7 percent probability) at typical operation of 100 MW thermal power (mode 1) were approximately 4.05 MW in heat power, 1.82^{0}F in inlet temperature, and 5.95 MW in perceived heat power on flux-to-flow ratio. The error bound in flow at the nominal flow trip point of 1500 gpm was approximately 86 gpm. The maximum unfavorable error in perceived heat power in flux-to-flow measurement was +420 kW for operation in research mode 2 (lower coolant flow and, hence, lower power; and approximately the same temperature difference as in mode 1), and +17.1 kW for mode 3 (no coolant flow, static operation, and, hence, low power). (auth)

8739 (UCRL-51906) NEUTRON RADIOGRAPHIC FACILITY AT THE 3-mw LIVERMORE POOL-TYPE REACTOR. Richards, W. J.; Peterson, R. T.; Prindle, J. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Sep 1975. Contract W-7405-Eng-48. 33p. Dep. NTIS $4.00.

A description is presented of the neutron experimental radiographic facility at the Livermore Pool-Type Reactor. This facility was installed in 1974 to assist Lawrence Livermore Laboratory research programs. Some of the testing techniques used to modify the neutron beam and the present radiographic parameters are also discussed. (auth)

8740 REPORT OF THE DOMESTIC REACTORS FACILITIES REVIEW PANEL [OF THE] SCIENCE BOARD, NEUTRON BEAM RESEARCH COMMITTEE. London; Science Research Council (1974). 84p.

Recommendations are made concerning the future requirements for medium flux facilities in the UK to carry out a program of Science Research Council sponsored condensed matter research complementary to that being carried out on the Institut Laue Langevin high flux reactor. In endorsing the recommendations the Science Board agreed that the proposed instrument portfolio should ensure a very worthwhile program of research for the next 5 to 10 years and welcomed the change in emphasis towards areas of research needing longer wavelength neutrons. The following subjects are covered: single crystal diffraction, powder diffraction, inelastic neutron scattering (chemistry and physics), polarized neutron techniques, diffuse scattering, liquids and amorphous materials, biology. The recommendations fall into three categories: (a) general improvements in accessories, data collection and handling, etc.; (b) new or substantially modified instruments requiring high priority; (c) instruments which it is hoped will eventually be developed. (UK)

Production and Materials Testing and Processing Reactors

Refer also to abstract 8738.

Propulsion and Package Reactors

Refer also to abstract 8759.

8741 (AED-CONF-75-272-001) MATURITY AND FUTURE OF NUCLEAR ENERGY. Weinberg, A. M. (Technische Hochschule Aachen (F. R. Germany). 1. Physikalisches Inst.). 1975. 8p. (In German). INIS.

From speech: maturity and future of nuclear energy; Karlsruhe, F. R. Germany (12 Jun 1975).

2 tabs.; 13 refs.

A short survey on the development of the present state of nuclear energy economy and some predictions about the next decades are presented. (GE)

8742 (LA-2590) ASPEN: AN AEROSPACE PLANE WITH NUCLEAR ENGINES. Bussard, R. W. (Los Alamos Scientific Lab., N. Mex. (USA)). 27 Sep 1961. Contract W-7405-Eng-36. 98p. Dep. NTIS $6.00.

Declassified 28 Aug 1973.

An analysis is presented of the potential performance capabilities of a class of manned, single stage, aerospace planes utilizing nuclear rocket engines for final boost flight into orbit, and comparison is made with chemical-energy-powered vehicles proposed for the same mission. Such vehicles have the capability of multiple reuse from successful flights, and of complete recovery from any non-catastrophic (i. e., airframe structural failure) abort situation. It is shown that the simplest nuclear-engined aerospace plane (ASPEN) considered is capable of placing 42.3% of its takeoff mass into a 300 n.mi. polar orbit, and that the most advanced versions may be able to carry 52.2% to polar orbit. Such figures imply the delivery of 3% to 17% of takeoff weight as useful payload, depending upon assumptions made for structural weight fraction and shielding. The simplest ASPEN system uses conventional turbojet engines, hydrogen-fueled ramjet engines, and nuclear rocket engines at performance levels expected in the Rover program by 1965. The reactor is never operated below 100,000 ft altitude; thus the major shielding problem reduces to that of protection against decay radiation after reactor shutdown. This problem is explored and it is shown that shielding may be carried sufficient to allow the use of conventional air bases. (auth)

Reactor Safety and Environmental Aspects

Refer also to abstracts 7266 and 8581.

8743 (AECL-5035, pp 28-31) APPLICATION OF THE METHOD OF CHARACTERISTICS TO TRANSIENT FLOW-BOILING. Hancox, W. T.; Mathers, W. G. (Whiteshell Nuclear Research Establishment, Pinawa, Manitoba). Win 1975.

In AECL research and development in engineering. (Atomic Energy of Canada Ltd., Chalk River, Ontario).

Transient analysis of steam-water flow in conduits is important in safety analysis associated with steam-water systems in nuclear plants. The method of characteristics, widely used in studies of gas flow, is extended to two-phase mixtures. A brief description of some recent work on the method of characteristics solution technique is presented. A wave tracing procedure, used extensively in gas dynamics is applied to flow-boiling dynamics. Special procedures have been developed to handle discontinuities and complex wave interactions which arise to phase changes (e.g. from steam to water or water to steam). (auth)

8744 (AED-CONF-75-159-003) USE OF RELIABILITY ANALYSIS FOR THE SAFETY EVALUATION OF TECHNICAL FACILITIES. Balfanz, H. P.; Eggert, H.; Lindauer, E. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). 1975. 21p. (In German). INIS.

From conference on technical reliability; Nuernberg, F. R. Germany (26 May 1975).

6 refs.

Using examples from nuclear technology, the following is discussed: how efficient the present practical measures are for increasing reliability, which weak points can be recognized and what appears to be the most promising direction to take for improvements. The following are individually dealt with: (1) determination of the relevant parameters for the safety of a plant; (2) definition and fixing of reliability requirements; (3) process to prove the fulfilment of requirements; (4) measures to guarantee the reliability; and (5) data feed-back to check and improve the reliability. (GE)

8745 (BMI-X-665) HAARM-2 USERS MANUAL. Task 56. Reed, L. D.; Gieseke, J. A. (Battelle Columbus Labs., Ohio (USA)). 31 Oct 1975. Contract W-7405-eng-92. 72p. Dep. NTIS $5.45.

A computer code for analyzing aerosol behavior within LMFBR containment during postulated accidents is described. The code allows time dependence of containment gas pressure and temperature as well as wall temperature gradients. (JMR)

8746 (BNL-20579) NOISE FROM COOLING TOWERS OF POWER PARKS. Zakaria, J.; Moore, F. K. Brookhaven National Lab., Upton, N. Y. (USA). 14 Oct 1975. 26p. Dep. NTIS $4.00.

A study is presented of the noise pollution problem for large power parks proposed for the future. Such parks might have an area of about 75 sq. miles, and a generating capacity up to 48000 MW. A comparative analysis has been done for natural and mechanical-draft wet towers as the major sources of acoustic power. Noise radiation from single isolated towers as well as from a dispersed array of towers has been considered for both types of cooling systems. Major noise attenuation effects considered are due to the atmospheric absorption and A-weighting. Conditions of 60F and 70 percent relative humidity in a still atmosphere have been assumed. (auth)

8747 (BNL-20583) STEAM GENERATOR AND CIRCULATOR MODEL FOR THE HELAP CODE. Ludewig, H. (Brookhaven National Lab., Upton, N.Y. (USA)). Jul 1975. 31p. Dep. NTIS $4.00.

An outline is presented of the work carried out in the 1974 fiscal year on the GCFBR safety research project consisting of the development of improved steam generator and circulator (steam turbine driven helium compressor) models which will eventually be inserted in the HELAP (1) code. Furthermore, a code was developed which will be used to generate steady state input for the primary and secondary sides of the steam generator. The following conclusions and suggestions for further work are made: (1) The steam-generator and circulator model are consistent with the volume and junction layout used in HELAP, (2) with minor changes these models, when incorporated in HELAP, could be used to simulate a direct cycle plant, (3) an explicit control valve model is still to be developed and would be very desirable to control the flow to the turbine during a transient (initially this flow will be controlled by using the existing check valve model); (4) the friction factor in the laminar flow region is computed inaccurately, this might cause significant errors in loss-of-flow accidents; and (5) it is felt that HELAP will still use a large amount of computer time and will thus be limited to design basis accidents without scram or loss of flow transients with and without scram. Finally it may also be used as a test bed for the development of prototype component models which would be incorporated in a more sophisticated system code, developed specifically for GCFBR's. (auth)

8748 (CONF-750966-1) ANALYSIS OF LMFBR PRIMARY SYSTEM RESPONSE TO AN HCDA USING AN EULERIAN COMPUTER CODE. Chang, Y. W.; Wang, C. Y.; Chu, H. Y.; Abdel-Moneim, M. T.; Gvildys, J. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 35p. Dep. NTIS $4.75.

From international conference on extreme load conditions and limit analysis procedures for structural reactor safeguards and containment structures; West Berlin, F. R. Germany (8 Sep 1975).

Applications of an Eulerian code to predict the response of LMFBR containment and primary piping systems to hypothetical core disruptive accidents (HCDA), and to analyze sodium spillage problems, are described. The computer code is an expanded version of the ICECO code. Sample problems are presented for slug impact and sodium spillage, dynamics of the HCDA bubbles, and response of a piping loop. (JWR)

8749 (CONF-750966-2) LMFBR SUBASSEMBLY RESPONSE TO LOCAL PRESSURE LOADINGS: AN EXPERIMENTAL APPROACH. Marciniak, T. J.; Ash, J. E.; Marchertas, A. H.; Cagliostro, D. J. (Argonne National Lab., Ill. (USA)). 1975. Contract W-31-109-Eng-38. 34p. Dep. NTIS $4.75.

From international conference on extreme load conditions and limit analysis procedures for structural reactor safeguards and containment structures; West Berlin, F. R. Germany (8 Sep 1975).

An experimental program to determine the response of LMFBR-type subassemblies to local subassembly accidents caused by pressure loadings is described. Some results are presented and compared with computer calculations. (JWR)

8750 (COO-2152-18) TWO PHASE PRESSURE DROP ACROSS ABRUPT AREA CHANGES IN OSCILLATORY FLOW. Weisman, J.; Ake, T.; Knott, R. (Cincinnati Univ., Ohio (USA)). May 1975. 80p. Dep. NTIS $5.45.

The ability of one-dimensional momentum balances to predict behavior during two-phase oscillatory flow has been examined. Flow oscillations in a Freon-Freon vapor system were induced by cycling a three-way valve so as to divert a varying portion of the total flow from the test section. The data taken included the phase shift between pressure and flow curves and the head fluctuation to flow fluctuation ratio. These data were compared to theoretical predictions. For void fractions below about 0.55, reasonable agreement between predictions and observations was obtained. At the highest void fractions examined, agreement between prediction and measurement was poor. However, at these high void fractions measurement errors may have been very substantial. Further, the simplifying assumptions required by the numerical calculation procedure chosen could no longer be considered valid. No real conclusion could therefore be drawn from the data at high voids. (auth)

8751 (DEU-75-16, pp 1-5) COMMENT OF THE REACTOR SAFETY COMMISSION OF 23rd JANUARY, 1974. 1974. (In German).

1 ref.

In peaceful use of nuclear energy. Statements of scientists: a documentation. (Ministerium fuer Wirtschaft, Mittelstand und Verkehr Baden-Wuerttemberg, Stuttgart (F. R. Germany)).

The reactor safety commission claims that the environmental influence of the nuclear power plants licensed according to the method applied in the FRG is negligible. (GE)

8752 (DEU-75-16, pp 6-10) COMMENT OF THE EXPERT DIVISION "RADIATION PROTECTION TECHNIQUES" ON THE ENVIRONMENTAL EFFECTS OF NUCLEAR POWER OF JANUARY, 1974. 1974. (In German).

1 ref.

In peaceful use of nuclear energy. Statements of scientists: a documentation. (Ministerium fuer Wirtschaft, Mittelstand und Verkehr Baden-Wuerttemberg, Stuttgart (F. R. Germany)).

The experts are of the opinion that by operating nuclear power plants, even in the future, no discernable additional risks from natural life risks are to be expected in the form of genetic or somatic damage. (GE)

8753 (DEU-75-16, pp 11-21) COMMENT OF THE AD HOC COMMITTEE OF THE CHAMBER OF PHYSICIANS SCIENTIFIC ADVISORY BOARD. 1974. (In German).

1 ref.

In peaceful use of nuclear energy. Statements of scientists: a documentation. (Ministerium fuer Wirtschaft, Mittelstand und Verkehr Baden-Wuerttemberg, Stuttgart (F. R. Germany)).

The ad hoc committee states that there is no danger to the population due to operation of nuclear power plants and that the panic feeling aroused by some is irresponsible. (GE)

8754 (DEU-75-16, pp 21-23) COMMENTS OF PROFESSORSHIP OWNERS FOR MEDICAL RADIOLOGY AT SWISS UNIVERSITIES. 1974. (In German).

1 ref.

In peaceful use of nuclear energy. Statements of scientists: a documentation. (Ministerium fuer Wirtschaft, Mittelstand und Verkehr Baden-Wuerttemberg, Stuttgart (F. R. Germany)).

The committe states that the risk of an additional exposure of the magnitude of 1 mrad in the environment of nuclear power plants to the population living there is completely neglible compared to the variations of the natural radiation exposure or the exposure due to medical use of ionizing radiation. (GE)

8755 (DEU-75-16, pp 25-33) NUCLEAR HAZARDS COMPARED TO OTHER RISKS. 1974. (In German).

1 tab.; 1 ref.

In peaceful use of nuclear energy. Statements of scientists: a documentation. (Ministerium fuer Wirtschaft, Mittelstand und Verkehr Baden-Wuerttemberg, Stuttgart (F. R. Germany)).

The nuclear risks are compared to the conventional risks (road accidents, industrial accidents, natural catastrophes etc.). (GE)

8756 (DEU-75-17) PROGRESS REPORT 1974. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). 1974. 110p. (In German). INIS.

20 figs.; 7 tabs. Available from ZAED.

Reported are organization and administration, main departments "fundamentals" and "facilities", licensing procedures for nuclear installations, tasks at the federal level, reports of the RSK and KTA departments, other activities, training and advanced training, reports, publications and lectures by the staff. (GE)

8757 (DEU-75-21) ENVIRONMENTAL HAZARDS FROM NUCLEAR POWER PLANTS. Bockelmann, D. (Zentralstelle fuer Atomkernenergie-Dokumentation, Leopoldshafen (F. R. Germany)). Apr 1973. 66p. (In German). INIS.

28 refs.; with figs.

The radiation exposure due to nuclear power stations in normal operation and after reactor incidents is discussed. Also mentioned

is the radiation exposure to the emissions from fuel reprocessing plants and radioactive waste facilities. (GE)

8758 (GEAP-14053) REVIEW OF SODIUM FIRE ANALYTICAL MODELS. Sarma, B. U. B.; Thompson, R. C.; Stitt, R. K. (General Electric Co., Sunnyvale, Calif. (USA). Fast Breeder Reactor Dept.). Jun 1975. 107p. AT.

A review of the available computer codes: SPRAY, SOFIRE II and CACECO was performed. These codes were utilized for analyzing sodium fires and modeling several sodium fire experiments conducted by Atomics International (AI). These results were inter-compared to evaluate the codes. Within a limited range of spray fires in low oxygen environments, the SPRAY code appears to yield reasonable results. It was found that CACECO is a large, multi-cell, multi-purpose code and inexpensive to use. Coding was implemented to facilitate extensive and detailed modeling of several simultaneous effects. A significant limitation of this code is its inability to model characteristics of spray fires and associated droplet combustion. SOFIRE II has been used to analyze pool fires in low oxygen and air environments. Satisfactory results could not be obtained at this time in the attempts to model the pool fire experiments. However, previously published reports (by AI) have shown the SOFIRE II calculations to compare favorably with the experiments. With careful application and using the SPRAY, SOFIRE II, and CACECO codes in conjunction with each other, primary sodium fires in inerted environment (less than or equal to 2 vol percent oxygen) can be adequately analyzed to obtain satisfactory results. In contrast, there is a significant deficiency, as there is no code available for analyzing spray fires in air environment. At the present time, at best, only most conservative and simplified calculations can be performed for analyzing spray fires in air. On-going analytical and experimental programs should provide the necessary support so as to eliminate the undue conservatism that is being applied for the sodium fire analyses at the present time. (auth)

8759 (GKSS-75/E/13) STUDY ON THE ASSESSMENT OF THE EFFECTS OF AN AIRPLANE CRASH ON THE SIDE WALL OF A NUCLEAR CONTAINER SHIP. Dietrich, R. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany). Inst. fuer Anlagentechnik). 1975. 42p. (In German). INIS.

18 figs.; 8 refs.

In order to assess the safety of the 80,000 SHP nuclear container ship against external influences, the impact of an airplane (PHANTOM) on the side wall of the ship is studied. The impact causes strain duc to penetration effects and dynamic deformation. The investigation of penetration showed that up to an impact velocity of about 775 km/h, no penetration of the collision protection structure is to be expected. The study to determine the dynamic behavior of the structure provides some knowledge on the fundamental frequencies and forms as well as on the dynamic traversing motions and the strain distribution. The maximum comparative strain according to the hypothesis of maximum form change is in the minimum strain region at the yield point of the employed shipbuilding steel St. 42. A breakdown of the structure on the impact of an airplane on the side wall need therefore not be expected. (GE)

8760 (HEDL-TC-372) JUSTIFICATION FOR POSITION THAT LOW LEVEL EARTHQUAKES (LESS THAN OR EQUAL TO 0.05g) RESULT IN NEGLIGIBLE DEGRADATION IN LIFETIME OF FFTF EQUIPMENT. Severud, L. K.; Metzger, F. S.; Weiner, E. O. (comps.). (Hanford Engineering Development Lab., Richland, Wash. (USA)). 3 Jun 1975. Contract E(45-1)-2170. 26p. AT.

An evaluation was performed to show that the degradation of FFTF equipment lifetime due to creep and fatigue damage caused by three 0.05g earthquakes with six maximum stress cycles each would be negligible. The results of the study are presented. (JWR)

8761 (HMI-B-178) SAFETY STUDIES ON THE MTR CORE OF THE BER II REACTOR. Buchholz, H.; Fischer, C. O.; Wasserroth, K. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany)). May 1975. 54p. (In German). INIS.

25 figs.; 5 tabs.; 15 refs.

Operation of the BER-2 reactor at the full power of 5 MW is described, and characteristic operational data are given. Experimental findings and calculations on the safety of the system are presented to show that a failure of the primary pumps does not lead to critical operating conditions. The demands made on the safe operation of the plant in the course of the licensing procedure are satisfactorily met with these findings. (GE)

8762 (IKE-2-9D) DETERMINATION OF THE PARAMETERS OF NORTON'S CREEP EQUATION FROM INTERNAL PIPE PRESSURE EXPERIMENTS. Elzmann, H. J. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Oct 1974. 65p. (In German). INIS.

19 figs.; 1 tab.; 8 refs.

The programme ZIRKON was established for the evaluation of measurements of the creep behavior of LOCA cladding tubes. This programme determines the parameters of Norton's creep equation from the measured values and also allows studies of the dependence of these parameters on characteristic physical values. Available measurements were evaluated using this programme, and the parameters are given with some reservations. The tangential voltage was seen as a constant in one of these cases and as a function of strain in the other. (GE)

8763 (IRS-A-8) IRS PUBLICATIONS 1965–1975. General Report. Schulz, W. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). May 1975. 48p. (In German). INIS.

A list is presented of all reports published in the various IRS series until May 31st, 1975, with titles and report numbers, as well as of publications in magazines and of conference reports. (GE)

8764 (IRS-F-24) RESEARCH REPORTS (ANNUAL REPORTS). State: End of 1974. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). May 1975. 529p. INIS.

With figs. and tabs.

This compilation of research reports is the third one to be published in the frame of a comprehensive reporting on current investigations with regard to reactor safety. (GE)

8765 (IRS-F-25) REPORTS ON THE RESEARCH PROGRAMS ON REACTOR SAFETY PROMOTED BY THE FEDERAL MINISTRY FOR RESEARCH AND TECHNOLOGY. Period Covered: January 1 to March 31, 1975. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). May 1975. 285p. (In German). INIS.

With figs. and tabs.

Investigations on fast breeder reactors are added to those concerning the safety of light water reactors. (GE)

8766 (IRS-W-14) NUCLEAR POWER PLANT LAYOUT AGAINST EXTERNAL INFLUENCES. Partial Aspect: Calculation of Force-Time Functions for the Impact of Deformable Projectiles on a Rigid Wall. Drittler, K.; Gruner, P. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Apr 1975. 47p. (In German). INIS.

16 figs.; 4 refs.

A numerical method is presented which allows for the calculation of the total force acting upon a building from impact of a projectile. The structural part to be hit by the projectile is assumed to be rigid; its surface is perpendicular to the direction of impact. Flight trajectory and projectile axis coincide. Variations of geometric and material properties across the projectile axis are replaced by proper average values. The method is tailored to safety considerations. A parametric study of the force resulting from impact of a fast flying military aircraft of the Phantom type is discussed. (All other types of fast flying military aircrafts yield similar or smaller forces.) The velocity prior to the impact is 215 m/s. It is shown that for safety considerations a simplified function between force and time can be established. (auth)

8767 (JUL-1189) FLOW MEASUREMENTS IN THE CORE OF THE FRJ-2 RESEARCH REACTOR AFTER THE INSTALLATION OF FLOW REGULATORS IN THE LOCATING BUSHES IN THE GRID AND INVESTIGATION OF THE CONSEQUENCES FOR THE SAFETY OF REACTOR OPERATION. Wolters, J. P. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Nukleare Sicherheitsforschung). Apr 1975. 96p. (In German). INIS.

23 figs.; 11 tabs.; 20 refs.

Early in June, 1974, radial flow regulators were installed in the locating bushes in the grid of the FRJ-2 reactor in order to reduce the flow irregularities in certain positions and thus to mobilize additional safety reserves. The success of these measures was tested by flow measurements in all 25 fuel element positions. The results are presented, their consequences for safety engineering are analyzed, and a flexible inlet temperature is proposed. (GE)

8768 (KFA-IRE-IB-20/72) CHANGES IN THE ENVIRONMENTAL IMPACT BY THE USE OF HTR REACTORS IN THE ENERGY CONSUMPTION GROUPS: CHEMICAL INDUSTRY, IRON- AND STEEL-PRODUCING INDUSTRY, PRIVATE HOUSEHOLDS. Engelhardt, H.; Manthey, C.; Eickhoff, G. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Sep 1972. 45p. (In German). INIS.

11 figs.; 13 tabs.; 36 refs.

Possible uses for HTR process heat, process steam and electricity in the energy consumption groups (1) chemical industry, (2) iron- and steel-producing industry, and (3) private households are assessed along with their supply potential. The changes in the environmental impact due to the possible use of this new technology (in particular the reduced emission of the pollutants SO_2, NO_x, and dust) are quantified and compared with the impact on the environment of conventional power stations. (GE)

8769 (KFK-1274/4, pp v) SAFETY OF FAST REACTORS. Instrumentation and Signal Processing by Reactivity Measurements. Froehlich, R.; Schmuck, P.; Thurnay, K.; Royl, P.; Zehlein, H.; Krieg, R.; Mattes, K.; Pappler, W.; Schleisiek, K.; Duesing, R. May 1975. (In German).

11 figs.; 1 tab.; with refs.

In 4th quarterly statement 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Projekt Schneller Brueter).

Major hypothetical incidents resulting in core disassembly have been calculated both for the SNR 300 (Mark Ia) and for a 1,000 MW(e) gas cooled breeder (GSB). In the SNR calculations the axial expansion in the fresh core was taken into account; it slightly reduces the energy release. The GSB calculations cover a shutdown rod ejection accident. An estimate of the potential of the occurence of a pin-to-pin failure propagation indicated that the probability of this case is low. The significance of transient behavior of spent fuel pins for the introductory phase of severe accidents was studied within the framework of a fuel pin failure model. Results of two series of measurements are available from out-of-pile boiling experiments (throttling of sodium flow) on a 7-pin bundle. No superheating was found at a heat flow density identical with that in the SNR. For the fuel-sodium interaction a new theoretical model is described (with axial subdivision of the reaction area) and preliminary results are quoted. An automatic method was developed to detect integral sodium boiling by reactivity measurements. In principle it seems to lend itself to monitoring large parts of an SNR reactor core. Also an acoustic method which is being studied in KNK may be eligible for boiling detection. Other methods of fault detection studied in KNK are based on noise measurements by means of fission chambers, thermocouples, ionization chambers, flowmeters and oscillation sensors. (auth)

8770 (KFK-2165, pp 1-9) AIR RECIRCULATION FILTER FOR THE DISCHARGE OF FISSION PRODUCTS FROM THE SAFETY CONTAINMENT ATMOSPHERE UNDER ACCIDENT CONDITIONS. Wilhelm, J. G. Jun 1975. (In German).

2 fig.; 1 tab.

In annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Lab. fuer Filtertechnik).

The test results of an iodine removal experiment on inorganic iodine sorption material of the AC 6120 type in a gamma radiation field at a dose rate of 2.6×10^7 rad/h are indicated. Studies on the use of AC 6120 in the HTR reactor containment building are outlined. First bench tests of a prototype post-accident recirculation filter are described. (auth)

8771 (MRR-145, pp 287-320) IMPORTANCE OF FLUX SHAPE CHANGES IN SPACE-TIME KINETICS CALCULATIONS. Dubois, G. (Ecole Polytechnique de Montreal). Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

A study was performed to determine if point kinetics models are suitable for calculating reactor behavior when rapid and localized pertubations are introduced into the core. It is shown that simplified kinetics models have serious drawbacks in the analysis of super-prompt-critical excursions. It is shown that a one-dimensional kinetics model is also unsuitable for describing this condition. The need for three-dimensional time-dependent diffusion calculations is pointed out. (JWR)

8772 (NEDO-21078) TEST RESULTS EMPLOYED BY GENERAL ELECTRIC FOR BOILING WATER REACTOR CONTAINMENT AND VERTICAL VENT LOADS. Fukushima, T. Y.; Singh, A.; James, A. J.; Winkler, W. D.; Walenciak, M. R.; Rosa, J. M. (General Electric Co., San Jose, Calif. (USA). Boiling Water Reactor Systems Dept.). Oct 1975. vp. General Electric Co., San Jose, CA.

During a safety relief valve blowdown, air contained in the relief line discharges into the suppression pool with the resulting oscillations of the air bubble causing dynamic loading on the containment. The magnitude and characteristics of such loading depend upon the geometry of the discharge device at the end of the safety relief line. Extensive small scale and large scale testing was performed to evaluate the performance of a four-arm quencher discharge device. Results of these tests, description of test facility, instrumentation and test procedures are described. During a loss-of-coolant accident, steam flows through vertical vent pipes such as employed in Mark I and II Containments and condenses in the suppression pool at the vent exit. During this condensation process, a steam bubble which forms at the vent exit will collapse irregularly leading to water impingement on the vent pipe. The water impingement phenomenon causes lateral loading on the vertical vents. The loading phenomena and series of tests performed to evaluate the load magnitudes are described. During a later part of the safety relief valve blowdown, steam discharges into the suppression pool through the safety relief line end discharge device. Extensive tests were carried out to investigate the high temperature condensation phenomenon and the temperature threshold limits for the occurrence of condensation vibrations for various configurations including the quencher configuration, of the relief line and discharge device. Results of these tests including a description of the test facility, instrumentation and test procedures have been included. (auth)

8773 (NP-20731) NUCLEAR CONTROVERSY INTERNATIONAL. Doederlein, J. M. (Studiengesellschaft zur Foerderung der Kernenergieverwertung in Schiffbau und Schiffahrt (Kernenergie-Studiengesellschaft), Hamburg (F. R. Germany)). Sep 1975. 41p. Dep. NTIS (US Sales Only) $5.00.

The controversy surrounding nuclear power is reviewed. The critics, their tactics, and the issues are examined. Some previous mistakes of nuclear proponents are discussed. An outline of a strategy for rational discussion of the issues is presented. (JWR)

8774 (ORNL-TM-5062) HTGR SAFETY STUDIES QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING DECEMBER 31, 1974, FOR THE GAS-COOLED REACTORS BRANCH, DIRECTORATE OF LICENSING. Sanders, J. P. Sr. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 22p. Dep. NTIS $4.00.

A thermal analysis for a Loss of Forced Circulation (LOFC) accident using a 2-dimensional model of the 2000-MW(t) Summit Station core was performed. Evaluation of modifications to the Preliminary Safety Analysis Report (PSAR) for both the Fulton and the Summit Stations concerning the performance of the Core Auxiliary Heat Exchanger (CAHE) has been made. Analysis of the stress in the metal cover plates for the insulation on the PCRV liner under normal operating and accident conditions has continued. Work has continued on the general development of computation methods for use in the determination of thermal conditions in the core and in the major components of the primary circuit during abnormal conditions. (auth)

8775 (ORNL-TM-5120) HTGR SAFETY STUDIES QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING JUNE 30, 1975 FOR THE GAS-COOLED REACTOR BRANCH, DIVISION OF REACTOR LICENSING. Sanders, J. P. Sr. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 17p. Dep. NTIS $4.00.

Work being performed for the Gas-Cooled Reactors Branch (GCRB) of the Division of Reactor Licensing (DRL) for their use in the evaluation of HTGR system response under abnormal conditions is reported. A major effort during this quarter has been the evaluation of the temperature in the Fort St. Vrain system following a design base depressurization accident (DBDA) with two of the circulators operating at 7000 rpm. (auth)

8776 (ORNL-TM-5128) QUARTERLY PROGRESS REPORT ON HIGH-TEMPERATURE GAS-COOLED REACTOR SAFETY STUDIES SPONSORED BY THE NRC DIVISION OF REACTOR SAFETY RESEARCH FOR JULY-SEPTEMBER 1975. Sanders, J. P. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 125p. Dep. NTIS $4.00.

Progress is reported on HTGR systems and safety analyses and computer code implementation. (JWR)

8777 (ORNL-TM-5155) MONTHLY PROGRESS REPORT FOR OCTOBER 1975 FOR THE HTGR SAFETY STUDIES FOR THE DIVISION OF TECHNICAL REVIEW, U.S. NUCLEAR REGULATORY COMMISSION. Sanders, J. P. (Oak Ridge National Lab., Tenn. (USA)). Nov 1975. Contract W-7405-eng-26. 5p. Dep. NTIS $4.00.

8778 SAFETY SEQUENCE ANALYSIS: A SYSTEMS APPROACH TO NUCLEAR SAFETY SYSTEMS DESIGN. Sokolsky, D. New York; Institute of Electronic and Electrical Engineers, Inc. (1975). 9p. $2.00.

From IEEE PES summer meeting; San Francisco, CA, USA (20 Jul 1975).

The factors which must be considered by nuclear power plant designers are constantly increasing. This is evidenced by the number of Atomic Energy Commission Regulatory Guides and IEEE Standards issued each year. Since total plant design necessitates the involvement of various design disciplines and organizations, the need for accurate documentation is recognized. The Safety Sequence Analysis (SSA) is a systematic design verification process that was developed to aid the design process and assure quality. Upon completion of the SSA, all nuclear plant safety functions that must be accomplished are determined; required safety-related systems, components, and equipment are identified; and a systems level failure modes and effects analysis is accomplished. A simplified example using the Loss of Coolant Accident, High Pressure Safety Injection System, and Onsite AC Power System is provided to demonstrate the analysis. (auth)

8779 REVISION AND ADDENDUM TO NUCLEAR SAFETY CRITERIA FOR THE DESIGN OF STATIONARY PRESSURIZED WATER REACTOR PLANTS. Hinsdale, IL; American Nuclear Society (1975). 5p. (ANSI-N18.2a-1975). $5.50.

A standard for containment and component safety classifications for PWR type reactors is presented. (JWR)

8780 NUCLEAR POWER STATION SAFETY. Rasmussen, N. C. (Massachusetts Inst. of Tech., Cambridge). ERA (Foeren. Elektr. Ration. Anvaendning); 47: No. 12, 238-242(1974).

There is a growing opposition by the general public to nuclear power stations on account of safety, but it is shown that the risk is very small. During many thousand reactor-years operation no fatalities have been reported, and the statistical risk per person per annum is estimated as 1 in 300×10^6. Radiation risks are discounted in comparison with natural radiation, medical dosage, etc. Fossil-fuel power stations pollute the environment with large amounts of CO_2, NO_X and SO_2, which can have serious consequences. Even hydro-electric power stations can affect the environment, e.g. the construction of the Aswan dam in Egypt has markedly reduced the fishing in the whole of the eastern part of the Mediterranean. A table is given comparing the basic environmental effects of a 100 MW coal-fired station with those of a nuclear station. (SW)

Reactor Theory and Calculation

Refer also to abstracts 8662, 8699, and 8771.

8781 (COO-2262-8) FINITE DIFFERENCE SOLUTION OF THE TIME DEPENDENT NEUTRON GROUP DIFFUSION EQUATIONS. Hendricks, J. S.; Henry, A. F. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Aug 1975. Contract AT(11-1)-2262. 198p. (MITNE-176). Dep. NTIS $8.50.

Thesis.

In this thesis two unrelated topics of reactor physics are examined: the prompt jump approximation and alternating direction checkerboard methods. In the prompt jump approximation it is assumed that the prompt and delayed neutrons in a nuclear reactor may be described mathematically as being instantaneously in equilibrium with each other. This approximation is applied to the spatially dependent neutron diffusion theory reactor kinetics model. Alternating direction checkerboard methods are a family of finite difference alternating direction methods which may be used to solve the multigroup, multidimension, time-dependent neutron diffusion equations. The reactor mesh grid is not swept line by line or point by point as in implicit or explicit alternating direction methods; instead, the reactor mesh grid may be thought of as a checkerboard in which all the "red squares" and "black squares" are treated successively. Two members of this family of methods, the ADC and NSADC methods, are at least as good as other alternating direction methods. It has been found that the accuracy of implicit and explicit alternating direction methods can be greatly improved by the application of an exponential transformation. This transformation is incompatible with checkerboard methods. Therefore, a new formulation of the exponential transformation has been developed which is compatible with checkerboard methods and at least as good as the former transformation for other alternating direction methods. (auth)

8782 (DP-MS-75-53) DETERMINATION OF DIFFUSION PARAMETERS USING RESPONSE MATRIX THEORY. Pryor, R. J.; Sicilian, J. M. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Nov 1975. Contract AT(07-2)-1. 12p. (CONF-751101-42). Dep. NTIS $4.50.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

A method is presented which provides the accuracy of the response matrix method, but without requiring the development of a response matrix reactor code. The method is used to determine diffusion parameters which, when used in conventional reactor diffusion codes, provide the same results as a response matrix reactor code. (auth)

8783 (EIR-271) "MIXED" METHOD, A SOLUTION OF THE TRANSPORT EQUATION IN CYLINDRICAL GEOMETRY MAKING USE OF BOTH ITS INTEGRAL AND DIFFERENTIAL FORMS IN HIGH P_n APPROXIMATION. Stepanek, J.; Ligou, J.; Maeder, C. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jan 1975. 57p. Dep. NTIS (US Sales Only) $5.50.

The "mixed" method is a solution of the coupled integral and differential forms of the transport equation using a polynomial approximation in space for one-dimensional multi zone systems with anisotropic scattering. Modifications made in the method to take account of highly anisotropic scattering, to improve the spatial approximation of the neutron flux, and to accelerate the computation are described. The properties of the resulting transport matrix are discussed and the important recurrence formulas between matrix elements are derived. 13 references. (auth)

8784 (KFK-2046, pp 258-275) IMPORTANCE OF THE CAPTURE CROSS SECTION OF STRUCTURAL MATERIALS FOR FAST POWER REACTORS. Barre, J. Y. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

6 figs.; 1 tab.; 3 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

The sensitivity of power reactor parameters to Fe, Cr and Ni capture rates and the present knowledge from integral experiments are discussed. (GE)

8785 (KFK-2046, pp 276-287) INFLUENCE OF THE CAPTURE CROSS SECTION OF IRON ON THE INTEGRAL PROPERTIES OF SOME FAST REACTOR CRITICAL ASSEMBLIES. Haeggblom, H. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

7 tabs.; 7 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

Calculations have been made on the sensitivities of fast reactor data to changes in the capture cross section of iron. ENDF/B-III neutron data library has been used for calculations on the FRO assembly on ZPR-III/32 and on the inner core of ZPPR-2. The SPENG library has been used for the ZPR-III cores 29, 35, 48, 53 and 55. (auth)

8786 (KFK-2046, pp 288-316) RELIABILITY OF CALCULATED CENTRAL REACTIVITY COEFFICIENTS OF STRUCTURAL MATERIALS. The Sensitivity of Ni, Fe, Cr Materials Worths to Uncertainties in the Cross Section Data. Heindler, M. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

14 figs.; 3 tabs.; 33 refs.

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

Central reactivity coefficients (CRCs) of the structural materials Cr, Fe, Ni and stainless steel are studied for a number of fast reactor assemblies. The discrepancies between measured and calculated material values are discussed. In order to localize possible sources of error, the relative contribution of absorption, elastic and inelastic scattering, and the sensitivity of the material values to errors in cross section data are brought in relation to the amount of disagreement between theory and measurement. (auth)

8787 (KFK-2046, pp 357-359) SUMMARY ON TOPIC III: USER ASPECTS. Kuesters, H. May 1975.

From NEACRP/NEANDC specialist meeting; Karlsruhe, F. R. Germany (8 May 1973).

In neutron capture in the keV energy range in structural materials for fast reactors. Proceedings. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Neutronenphysik und Reaktortechnik).

The impact of capture cross sections of structural materials on physics quantities in fast reactors is discussed. The results from papers presented at the NEACRP/NEANDC specialist meeting held in May 1973 at the Kernforschungszentrum Karlsruhe are summarized. (GE)

8788 (KFKI-75-62) SELECTING FROM THREE PROBABILITY DISTRIBUTIONS FOR REACTOR CALCULATIONS. Lux, I. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1975. 22p. Dep. NTIS (US Sales Only) $4.50.

Three kinds of probability density functions are investigated, which are used for reactor calculational purposes, and procedures are given for selecting random numbers distributed according to them. These distributions are the truncated exponential distribution, the Maxwellian distribution and the energy distribution of the slowing down source of neutrons respectively. The FORTRAN lists of the selecting procedures and the mean ICL 1905 running time of them are also given. 15 references. (auth)

8789 (MRR-145) PROCEEDINGS OF THE JOINT NEACRP/CSNI SPECIALISTS' MEETING ON NEW DEVELOPMENTS IN THREE-DIMENSIONAL NEUTRON KINETICS AND REVIEW OF KINETICS BENCHMARK CALCULATIONS, GARCHING, 22nd–24th JANUARY 1975. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung). Mar 1975. 573p. (CONF-750134-).

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

Separate abstracts were prepared for each of the 14 papers included. All abstracts are included in NSA and one is presented in ERA. (JWR)

For abstracts of individual papers see: 8660–8663, 8699, 8706, 8771, and 8790–8796.

8790 (MRR-145, pp 3-20) APPROXIMATIONS THAT MAKE SPACE-DEPENDENT KINETICS COMPUTATIONS MORE EFFICIENT. Henry, A. F. (Massachusetts Inst. of Tech., Cambridge). Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

Approximate methods for solving equations describing neutronics in reactor cores during transients are discussed. Synthesis methods, response matrix techniques, homogenized group diffusion parameters, flux predictions for large homogeneous cores, and boundary conditions are examined. (JWR)

8791 (MRR-145, pp 21-72) A: STABLE ALGORITHMS FOR NEUTRON KINETICS. Devooght, J.; Mund, E. (Univ. Libre, Brussels). Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

Benchmark problems are interesting not only as a common meeting ground of different numerical algorithms but as a means to check their soundness or conformity to the underlying theory, if any. Although some numerical algorithms devised to integrate the space dependent kinetics are well founded, others are on a more shaky ground and therefore not completely trustworthy. On the other hand, numerical schemes with a theoretical small truncation error may not always fare as well as they are supposed to. The first part of this paper deals with some general features of a space dependent kinetics code, stressing the properties of A-stability and spectral matching. The second part summarizes the main characteristics of a new A-stable algorithm that is flexible enough and encompasses many existing schemes. Some extrapolation procedures are discussed. A Newton series interpolation with a permanence property is introduced. The third part, finally, describes two numerical applications of the $W_{11}(u/u_1, u_2)$ time-integration scheme and their related conclusions. (auth)

8792 (MRR-145, pp 73-87) MULTIPLE TEMPORAL-MODE ANALYSIS FOR THREE-DIMENSIONAL REACTOR DYNAMICS. Harms, A. A.; Garland, W. J.; Pearce, W. A.; Harding, M. F.; Trojan, O. A.; Vlachopoulos, J. (McMaster Univ., Hamilton, Ont.). Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

A multiple temporal-mode transformation combined with spatial differencing is developed and applied in a two-group, three-dimensional reactor dynamics analysis using the diffusion approximation. It is found that this solution formalism leads to an apparently efficient and effective method for the study of fast transients for time intervals before a global flux trend has been established. Calculational results for a simplified cylindrical reactor under conditions of a fast transient and some general properties of the formalism are discussed. (auth)

8793 (MRR-145, pp 191-205) BITNOD METHOD OF REACTOR COARSE MESH CALCULATIONS. Norinder, O. (Aktiebolaget Atomenergi, Studsvik, Sweden). Mar 1975.

For joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

A new methodology is described for accurate determination of flux distributions in coarse-mesh calculations. Principles, results of a first test phase and development status are noted. (auth)

8794 (MRR-145, pp 257-286) SPATIAL KINETICS PROGRAM SPARK AND ITS APPLICATION TO FAST REACTOR TRANSIENTS. Fletcher, J. K.; Perks, M. A. (United Kingdom Atomic Energy Authority, Risley). Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

The one, two and three-dimensional fast reactor kinetics code SPARK with space and energy dependence of the neutron flux is described. The solution of the equations is discussed and then a description of the neutronics, heat transfer, and feedback formulation is presented. The program was used to calculate the two-dimensional fast reactor benchmark problem, the results of which are being presented at the conference. The program has also been used to study several types of transients leading to can failure or fuel melting and some typical examples are presented. (auth)

8795 (MRR-145, pp 323-411) SURVEY OF THE RESULTS OF A ONE-DIMENSIONAL KINETIC BENCHMARK PROBLEM TYPICAL FOR A THERMAL REACTOR. Billington, D. E. (United Kingdom Atomic Energy Authority, Risley); Buffoni, G.; Childs, E. H. Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

Several solutions to a series of one-dimensional kinetics problems are reviewed. The basis of the problem was to compute an initial state and then to follow a transient caused either by moving a control rod or by varying cross section. The various codes developed were compared for speed and reliability. (JWR)

8796 (MRR-145, pp 505-551) SURVEY OF THE RESULTS OF A TWO-DIMENSIONAL KINETIC BENCHMARK PROBLEM TYPICAL FOR A FAST REACTOR. Buffoni, A. (CNEN, Casaccia, Italy); Fletcher, J. K.; Galati, A.; McDonnell, F. N.; Musco, A.; Vaeth, L. Mar 1975.

From joint NEACRP/CSNI specialists' meeting on new developments in three dimensional neutron kinetics and review of kinetics benchmark calculations; Garching, F. R. Germany (22 Jan 1975).

In proceedings of the joint NEACRP/CSNI specialists' meeting. (Technische Univ. Muenchen, Garching (F. R. Germany). Lab. fuer Reaktorregelung und Anlagensicherung).

Several solutions to a two-dimensional fast reactor kinetics benchmark problem are discussed and compared. (JWR)

8797 FISSIONING URANIUM PLASMAS AND NUCLEAR-PUMPED LASERS. Schneider, R. T. (Office of Naval Research, London); Thom, K. Nucl. Technol.; 27: No. 1, 34-50(Sep 1975).

A variety of applications of plasma core reactors and nuclear-pumped lasers is envisioned for benefits in space and on earth. Such benefits include advanced propulsion in space, terrestrial power generation approaching 70 percent efficiency, the possibility of nuclear burnup of transuranium actinides wastes, and the breeding of ^{233}U from thorium. The research on gaseous fuel reactors and nuclear-pumped lasers predominantly requires expertise in

nuclear engineering, plasma, atomic, and molecular physics, fluid mechanics, and chemistry. A multidisciplinary effort is seen as a logical approach. (auth)

8798 SULLA CONNESSIONE DEL CAMPO TERMICO AL PARAMETRO DI SFORZO TERMICO, IN REATTORI NUCLEARI. (Relationship of the Thermal Field to the Thermal-Stress Parameter in Nuclear Reactors). D'Elia, G. Naples; University of Naples (1974). 30p.

A "maximum thermal-stress parameter" has been used to characterize the mechanical behavior of the basic material of a nuclear reactor, whose thermal field is studied in relation to this parameter. The maximum thermal-stress condition is imposed on a discrete number of points. This causes an adjustment with respect to the "natural" case of the "thermal-energy production" function and an improvement in the power density of the reactor, which is expressed by a "factor of merit". The practical advantage of the method is shown by a numerical application to the case in which graphite is used as basic material. (auth)

8799 OPTIMAL CONTROL ROD PROGRAMS IN POWER REACTORS. Fadilah, S. M.; Lewins, J. (Queen Mary Coll., London). Annals of Nuclear Energy; 2: No. 6, 443-450(Jul 1975).

Control rod programming is investigated with respect to optimizing the power peaking factor and hence the utilization of a nuclear reactor. A simplified diffusion model, initially with a finite number of regions, in cylindrical geometry is used to enable optimal trajectories to be completely synthesized. The average discharge burnup problem is posed both as an external and as an internal optimization. The connection between optimum power shape and the maximization of the average discharge burnup is explored in a wider context. It is shown that optimum trajectories combine an initial singular solution of the Haling type with a terminal bang-bang solution. An extension to a higher number of regions and, on passing to the limit, to a diffusion model, provides an alternative proof of Haling's principle without the restriction to monotonic reactivity decrease with burnup. Numerical results in the two-region model are given to show the general scope of optimization available. (auth)

8800 NEW CONTINUOUS SLOWING-DOWN THEORY FOR RESONANCE AND ANISOTROPIC ELASTIC SCATTERING. Itoh, S. I. (Hitachi Ltd., Kawasaki, Japan); Yamamoto, H. Nucl. Sci. Eng.; 58: No. 4, 436-449(Dec 1975).

A continuous slowing-down theory is applied to the calculation of neutron spectra for elastic moderation in a fast reactor assembly. The model yields very accurate results for the neutron spectra in the resolved resonance region of fuel materials and in the wide scattering resonance region. The characteristic features of the the slowing-down parameters are also studied for the anisotropic scattering in the center of mass system. (auth)

8801 SENSITIVITY OF THE LUMPED FISSION-PRODUCT MODEL TO DIFFERENT FISSION-PRODUCT CROSS-SECTION LIBRARIES. Ilberg, D.; Saphier, D.; Yiftah, S. (Soreq Nuclear Research Center, Yavne, Israel). Nucl. Sci. Eng.; 58: No. 4, 445-449(Dec 1975).

The extent to which the use of different fission-product cross sections (FPCS) affects the neutron multiplication factor k/sub eff/ in high burnup cores of fast reactors is evaluated. It is found that discrepancies of the order of 2.5 percent exist when different FPCS are used to calculate k/sub eff/ in the same core. These discrepancies are due to the absence of data on a number of fission-product isotopes present in some of the nuclear data libraries on the one hand, and large differences in the capture cross sections of some of the isotopes on the other. A list of fission-product isotopes is proposed that, when used, reduces discrepancies in k/sub eff/ to less than 1 percent. The important isotopes for fast-reactor burnup and k/sub eff/ calculations in which large discrepancies exist are identified, and it is suggested that they be subjected to further evaluation to close the discrepancy gap. (auth)

Reactor Components and Accessories

Refer also to abstract 7256.

8802 (ORNL-5070) NOISE RADIATION FROM NATURAL-DRAFT COOLING TOWERS FOR NUCLEAR POWER PLANTS. Carley, T. G. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 27p. Dep. NTIS $4.00.

A procedure for computing the noise levels in the vicinity of natural-draft cooling towers is presented. The noise levels are computed in overall and octave band levels with A-weighting and with no weighting. Attenuation of the noise by wave spreading, atmospheric absorption, barrier screening, vegetation, and wind and temperature gradients are included. The procedure is applied to a nuclear power plant served by four cooling towers and to a nuclear energy center with forty cooling towers. (auth)

8803 (ORNL-TM-5108) MONTHLY PROGRESS REPORT FOR SEPTEMBER 1975 FOR THE HTGR SAFETY STUDIES FOR THE DIVISION OF TECHNICAL REVIEW, U. S. NUCLEAR REGULATORY COMMISSION. Sanders, J. P. (Oak Ridge National Lab., Tenn. (USA)). Oct 1975. Contract W-7405-eng-26. 7p. Dep. NTIS $4.00.

8804 CLASSIFICATION AND CRITERIA FOR SAFETY RELATED ELECTRICAL EQUIPMENT IN NUCLEAR POWER PLANTS. Crotzer, M. E.; Rossi, C. E. New York; Institute of Electronic and Electrical Engineers, Inc. (1975). 4p. $2.00.

From IEEE PES summer meeting; San Francisco, CA, USA (20 Jul 1975).

The inadequacies of the 1E safety classification for electrical equipment in nuclear power plants are addressed. Two safety classes are proposed and requirements for each are given. The first applies primarily to electrical equipment that must perform during or after an accident. The requirements for this class are essentially the same as those for reactor protection systems. The second class applies primarily to electrical equipment that has a safety related function, but may not be needed during or after an accident. Some requirements of the first class can be relaxed for the second class if the nuclear plant can be placed in a condition where equipment in the second class is not needed should it fail. (auth)

8805 TIGHT JOINT, TOGETHER WITH THE METHOD TO PRODUCE THE LIKE. Johnsson, E. B. (to Aktiebolaget Atomenergi). Swedish Patent 367,688. 12 Sep 1974. 4p. (In Swedish)

A description is provided of a compact joint comprising a toroidal flanged ring between a lug in a pressure vessel, especially a reactor tank, and a shoulder on its lid, which rests against a store in the vessel, characterized by the fact that the toroidal ring is arranged so that its outer, respectively inner flange rests against the lug and the shoulder, that a stay ring for the support legs to the lid is placed against the top side of the inner flange, whereby the inner flange is kept clamped on the shoulder of the lid, while the support legs are adjusted, and that the outer toroidal flange is fastened against the lug, preferably by means of a radially displaceable clamp. (SW)

8806 LOCKING DEVICE INTENDED AS A LID FOR A PRESSURE VESSEL. Johnsson, E. B. (to Aktiebolaget Atomenergi). Swedish Patent 363,389. 25 Apr 1974. 10p. (In Swedish).

A description is provided of a locking device intended as a lid for a pressure vessel, including a number of supporting legs, disposed all along the circumference of the lid, a shoulder on the lid for the lower and of the supporting leg, and also a shoulder on the pressure vessel for the upper end of the supporting leg, characterized by the fact that the lower end of the supporting leg is so fitted up on a supporting tray that it can pivot, that the supporting tray is movingly adjusted perpendicular to the circumference of the lid, that a slide, hydraulic or pneumatic, is fitted so as to be movable to the supporting leg essentially in a vertical direction, that the slide is coupled up to the supporting leg by means of a link arm, so as to swith this one into and out of engagement with the shoulder on the pressure vessel, that the slide is coupled up to the supporting tray, by means of a spring link arm, in order to bring the supporting tray perpendicular outwards to the circumference of the lid, with a view to a setting up of the supporting leg, and also in order to alloy to apply a wedge to the supporting tray, and also that the wedge is disposed so as to be brought by the slide into engagement with the supporting tray for its driving to the position where the supporting leg is clamped between the pressure tank and the lid as well as for the locking of the supporting tray in this position. (SW)

Reactor Fuels

Refer also to abstracts 7175 and 7808.

8807 MEASURED AND CALCULATED FISSION-PRODUCT POISONING IN NEUTRON-IRRADIATED URANIUM-233. Gunst, S. B.; Connor, J. C.; Conway, D. E. (Westinghouse Electric Corp., West Mifflin, PA). Nucl. Sci. Eng.; 58: No. 4, 387-413(Dec 1975).

Samples of ^{233}U and of natural thorium have been irradiated in high neutron-flux facilities, in both soft and hard neutron spectra,

and for both short and long exposure times. Included are exposures resulting in depletions of more than 90 percent of the ^{233}U in the fissile material and burnups of more than 30,000 MWd/MT in the fertile material. Fission-product poison cross sections in two energy groups (thermal and epithermal) exhibit differences between measurement and calculation that are believed to be attributable to a lack of adequate information on important fission products in the literature. Experimental results for transient absorbers in irradiated ^{233}U give at least 20,000 b for the neutron absorption resonance integral of ^{149}Pm. This is a factor of 15 higher than that obtained by a 1/v extrapolation of the thermal cross sections. For transient ^{135}Xe, the measured absorption is 7.5 percent higher than that calculated using ENDF/B-IV data. Information is also provided concerning such matters as fission yields and neutron absorption of neodymium isotopes, the existence of significant transient fission-product poisons other than ^{135}Xe and ^{149}Sm, and the shielding of ^{233}U by ^{232}Th. Such shielding suggests the need for a change in the energy dependence of the ^{232}Th thermal-neutron cross section. (auth)

8808 CORE LATTICE FOR A NUCLEAR REACTOR. Suvanto, A. (to ASEA-ATOM AB). Swedish Patent 362,307. 14 Mar 1974. 3p. (In Swedish)

A description is presented of a core intended for a nuclear reactor, which contains a number of polygonal fuel blocks, disposed quite close to one another, each of which contains at least one polygonal fuel cartridge, characterized by the fact that the fuel blocks are so displaced in proportion to one another, parallel to the side surfaces that face on to one another, that openings — enclosed by the fuel blocks — are formed between the fuel blocks. (auth)

Reactor Control Systems

8809 (DP-MS-75-60) CONTROL ALGORITHMS IN A COARSE-MESH REBALANCE FRAMEWORK. Gregory, M. V.; Honeck, H. C. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Nov 1975. Contract AT(07-2)-1. 24p. (CONF-751101-44). Dep. NTIS $4.25.

From joint meeting of the American Nuclear Society and the Atomic Industrial Forum; San Francisco, California, USA (16 Nov 1975).

Control algorithms for power shaping calculations and critical rod bank position searches are described. The algorithms allow a flux computation module using a finite difference solution of the few-group neutron diffusion equations with coarse-mesh rebalancing to be directly extended to control calculations. The control algorithms are formulated as an extension of the standard critical buckling search by recasting the procedure for calculating the eigenvalue. A comparison of the power shaping calculation with an equivalent k/sub eff/ calculation demonstrates that the former requires approximately the same number of outer iterations as the latter. (auth)

8810 (JUL-1206) INVESTIGATIONS ON THE OPERATING AND CONTROL BEHAVIOR OF HTR-HELIUM TURBINE PLANTS. Hewing, G. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Jun 1975. 118p. (In German). Dep. NTIS (US Sales Only) $6.50.

Thesis. Submitted to Technische Hochschule, Aachen.

Investigations on the operating and control behavior of closed-cycle HTR-Helium turbine plants are described. The aim of these investigations is to prove that the requirements of the grid can be met by the power plant without undue operating conditions. This study refers to a non-integrated and an integrated design of a single-shaft-plant. For comparison the behavior of an adequate split-shaft-arrangement is opposed. 42 references. (auth)

8811 REACTOR CONTROL RODS WITH DIFFERENTIAL ABSORBER CONTENT. Brunzell, P. (to ASEA-ATOM AB). Swedish Patent 364,134. 22 May 1974. 6p. (In Swedish)

A description is presented of a boiling-water reactor comprising a nucleus of vertical fuel rods and a number of control rods, which can be moved in a vertical direction, whereby the control rods contain absorber material, spread in the longitudinal direction, characterized by the fact that a control rod is made at its upper end, along 25% at most of its length with such a content of absorber material that the average value per unit of length is at the most ⅓ of the corresponding average value of the rest of the rod. (SW)

Nuclear Power Plant Economics

8812 9TH WORLD ENERGY CONFERENCE, DETROIT, MICHIGAN, SEPTEMBER 22–27, 1974. Preprints. Division 1: Population and Energy Resources. London; World Energy Conference (1974). vp. (In English and French). (CONF-640910–P1).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974).

Fifty-two papers were presented. Three items were announced in NSA. (PCS)

For abstracts of individual papers see: 8813, 8814, and 8817.

8813 TRENDS OF APPLICATION OF POWER ENGINEERING UNITS USING NUCLEAR AND FOSSIL FUELS IN CZECHOSLOVAKIA. Drahy, J. (Skoda, Plzen, Czech.); Hulovec, J.; Komarek, A.; Kovac, J.; Libich, V. pp Paper 1.2–25, 14p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-640910–P1.

8814 FAST AND THERMAL BREEDERS. Nuclear Energy in The Netherlands. Nijs, W. W.; Hermans, M.E.A.; Wiechers, W. K. pp Paper 1.2–26, 21p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910–P1.

8815 PROFITABILITY OF NUCLEAR POWER STATIONS: NO GROUNDS FOR PESSIMISM. Margen, P.; Lindhe, S. (Aktiebolaget Atomenergi, Stockholm). Tek. Tidskr.; 105: No. 4, 16-19(28 Feb 1975). (In Swedish)

Operating experience of nuclear power stations in the U.S.A., covering a period of 15 years and 166 reactor-years, gives no basis for a pessimistic view of the profitability of nuclear power stations. Details are given of reliability, availability factor, and capacity factor. (SW)

Reactor Fuel Cycle Economics

Refer also to abstracts 7030 and 7031.

8816 (ERDA--73) INDEPENDENT ASSESSMENT OF FORSEEABLE PROBLEMS IN THE NUCLEAR FUEL CYCLE. (Stoller (S.M.) Corp., New York (USA)). 18 Apr 1975. Contract AT(49-1)-3695. 290p. Dep. NTIS $7.60.

Information is presented concerning the U. S. nuclear fuel cycle business including investment requirements; nuclear power growth projection; reliability of uranium supply; enrichment facilities; plutonium recycle; safeguards; and insurance. (DCC)

8817 NUCLEAR ENERGY: ITS GROWTH AND IMPACT ON THE CANADIAN ECONOMY. pp Paper 1.3-2, 17p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910–P1.

Reactor Licensing and Regulation

8818 (TID-26811(P4)) ATOMIC ENERGY COMMISSION REPORTS. Volume 4. (USAEC, Washington, D. C.). 1973. 1439p. GPO $14.70.

The opinions and decisions of the Atomic Energy Commission, Atomic Safety and Licensing Appeal Boards, Atomic Safety and Licensing Boards, Board of Contract Appeals, and the Contract Adjustment Board are presented for the period July 1, 1967 to June 30, 1972. (HDR)

8819 (TID-26811(P7)) ATOMIC ENERGY COMMISSION REPORTS. Volume 7. (USAEC, Washington, D. C.). 1975. 1435p. GPO $16.85.

This is the seventh volume of issuances of the Atomic Energy Commission, Atomic Safety and Licensing Appeal Boards, Atomic Safety and Licensing Boards, Board of Contract Appeals, and Contract Adjustment Board and covers the period from January 1, 1974, to June 30, 1974. This volume is made up of reprinted pages from the six monthly issues of the Atomic Energy Commission publication Regulatory Adjudication Issuances and Issuances of the Board of Contract Appeals (RAI), for this time period, arranged in chronological order. Cross references in the text and indexes are to RAI page numbers which are the same as the page numbers in this publication. A separate index for the Board of Contract Appeals is included. (auth)

8820 (TID-26811(P8)) ATOMIC ENERGY COMMISSION REPORTS. Volume 8. (USAEC, Washington, D. C.). 1975. 1328p. GPO $15.95.

This is the eighth and final volume of issuances of the Atomic

Energy Commission and its Atomic Safety and Licensing Appeal Boards, Atomic Safety and Licensing Boards, and Board of Contract Appeals and covers the period from July 1, 1974, to January 18, 1975. The issuances of the Nuclear Regulatory Commission (NRC) and of the Licensing Boards and Appeal Boards that are now under its cognizance will be published in the future by NRC as NRC Reports. The Board of Contract Appeals became part of ERDA. This volume is made up of reprinted pages from the last six 1974 monthly issues (July–December) plus the final issue for the period from January 1 to 18, 1975, of the Atomic Energy Commission publication Regulatory Adjudication Issuances and Issuances of the Board of Contract Appeals (RAI). The material is arranged in chronological order. Cross references in the text and index are to RAI page numbers, which are the same as the page numbers in this publication. A separate index for the Board of Contract Appeals is included. (auth)

GENERAL AND MISCELLANEOUS

Management

8821 (AECL-5247) AECL PRESENT AND FUTURE. Foster, J. S. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1975. 21p. (CONF-750699-2). Dep. NTIS (US Sales Only) $4.50. AECL $1.00.

From 15th annual international conference; Ottawa, Canada (15 Jun 1975).

This is a history of Atomic Energy of Canada Limited with forecasts of its role in enabling Canada to meet a rapidly increasing share of her energy requirements from nuclear power. Its main activities will be research and development in support of contemporary and advanced CANDU (Canada Deuterium Uranium) nuclear power systems, research into other ways to provide energy and fissile materials, and investigation into applications for nuclear energy beyond the generation of electrical power. (6 figures) (auth)

8822 (LA-5900-MS) PUBLICATIONS OF LASL RESEARCH, 1974. Kerr, A. K. (Los Alamos Scientific Lab., N. Mex. (USA)). May 1975. Contract W-7405-ENG-36. 310p. Dep. NTIS $7.60.

This bibliography includes Los Alamos Scientific Laboratory reports, papers released as non-Los Alamos reports, journal articles, books, chapters of books, conference papers (whether published separately or as part of conference proceedings issued as books or reports), papers published in congressional hearings, theses, and U. S. patents. Publications by LASL authors which are not records of Laboratory-sponsored work are included when the Library becomes aware of them. The entries are arranged in sections by broad subject categories; within each section they are alphabetical by title. The following subject categories are included: aerospace studies; analytical technology; astrophysics; atomic and molecular physics, equation of state, opacity; biology and medicine; chemical dynamics and kinetics; chemistry; cryogenics; crystallography; CTR and plasma studies; earth science and engineering; energy (non-nuclear); engineering and equipment; EPR, ESR, NMR studies; explosives and detonations; fission physics; health and safety; hydrodynamics and radiation transport; instruments; lasers; mathematics and computers; medium-energy physics; metallurgy and ceramics technology; neutronic and criticality studies; nuclear physics; nuclear safeguards; physics; reactor technology; solid state science; and miscellaneous (including Project Rover). Author, numerical and KWIC indexes are included. (RWR)

Mathematics and Computers

Refer also to abstracts 7289 and 7577.

8823 (AECL-5035) AECL RESEARCH AND DEVELOPMENT IN ENGINEERING. (Atomic Energy of Canada Ltd., Chalk River, Ontario). Win 1975. 43p. Dep. NTIS (US Sales Only) $5.25. AECL $1.50.

The structure of the computing center at Chalk River Nuclear Laboratories is described, and then the use of the computer in project management at Chalk River is discussed. The computer helps with specifying, ordering work, scheduling, cost estimating, and cost monitoring. Additional sections deal with various applications of the computer in the nuclear field. Separate abstracts were prepared for each of these latter six sections. (RWR)

For abstracts of individual papers see: 7171, 7398, 8701–8703, and 8743.

8824 TO THE SYSTEMATIZATION OF FAILURE ANALYSIS FOR PERTURBED SYSTEMS. Haller, U. Munich; Technische Univ. (1974). 153p. (In German). INIS.

Thesis.

The paper investigates the reliable functioning of complex technical systems. Of main importance is the question of how the functioning of technical systems which may fail or whose design still has some faults can be determined in the very earliest planning stages. The paper develops a functioning schedule and presents possible methods of systematic failure analysis of systems with stochastic failures. (GE)

Miscellaneous

Life Sciences

8825 BIOMEDICAL ASPECTS OF NUCLEAR ENGINEERING EDUCATION. Brownell, G. L.; Murray, B. W. (Massachusetts Inst. of Tech., Cambridge). Nucl. Technol.; 27: No. 1, 60-66(Sep 1975).

Based on the experience at MIT, nuclear engineering can play a vital role in training research personnel for nuclear medicine, diagnostic radiology, and radiation therapy. Any individual nuclear engineer wishing to engage in the training of students for such fields should establish a close rapport with research scientists and clinicians within a medical institution and be familiar with the medical resources available for such training. (auth)

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